AUGUST 8, 1955

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION

Electricity Cuts Dairy Labor Costs

. . . Page 80

European EHV Practices

. . . Page 70

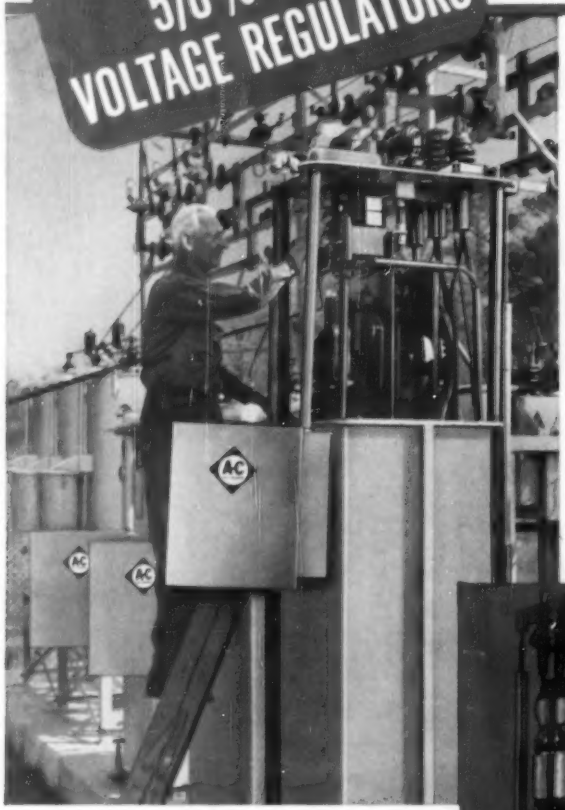
ELECTRICAL WEEK

. . . Page 58

This Regulator is Cover Suspended . . .

ALLIS-CHALMERS
5/8% STEP
VOLTAGE REGULATORS

Easier to Inspect than any other



Routine inspections cost less both in time and manpower with Allis-Chalmers single-phase regulators. They are easier to inspect than any other regulator on the market. All components are cover suspended when untanking. All you do is remove a few cover bolts and control cabinet mounting bolts. Then just hoist up on the cover and the entire unit comes out of the tank. There is no oil to handle; no leads to break.

To check operation, just attach an external power source to the control leads. The regulator operates in normal fashion outside the tank as well as inside. There are no special connections to make.

Conveniences like these are the natural result of step regulator experience. No other manufacturer can match Allis-Chalmers 20 years of 5/8% step regulator experience. And no other 5/8% step regulator offers you so many years of solid proof of utility satisfaction.

For more information, consult the A-C office nearest you or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4769

It's easy to untank an Allis-Chalmers single-phase regulator with a truck crane, block and tackle, or with this more convenient inspection jack. Designed to help you take advantage of Allis-Chalmers unique cover-suspension feature, this jack can be used either on distribution regulators or single-phase power regulators. Jacks are available—see your nearby Allis-Chalmers office.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

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Published for 81 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Vol 144 No 6 **August 8, 1955**

EDITORIAL AND COMMENTARY

Editorials 57
Technical Notes 194
Washington Comment 194
Readers Forum 192
Book Reviews 164

INDUSTRY NEWS

Electrical Week 58, 59
Current Events 60-65
News about People 174
Meetings Calendar 180
Manufacturers and Markets ... 168

MANAGEMENT

Statistics 199
Finance and Regulation 196
Public Relations 190

GENERATION

Design 66, 76, 84
Maintenance 114

SUBSTATIONS

Design 83, 84, 116
Construction 83
Operation 104
Maintenance 97

TRANSMISSION

Design 70
Operation 93

INDUSTRIAL

Operation 100, 120

SALES

Residential 68, 141
Commercial 128
Rural 68, 80

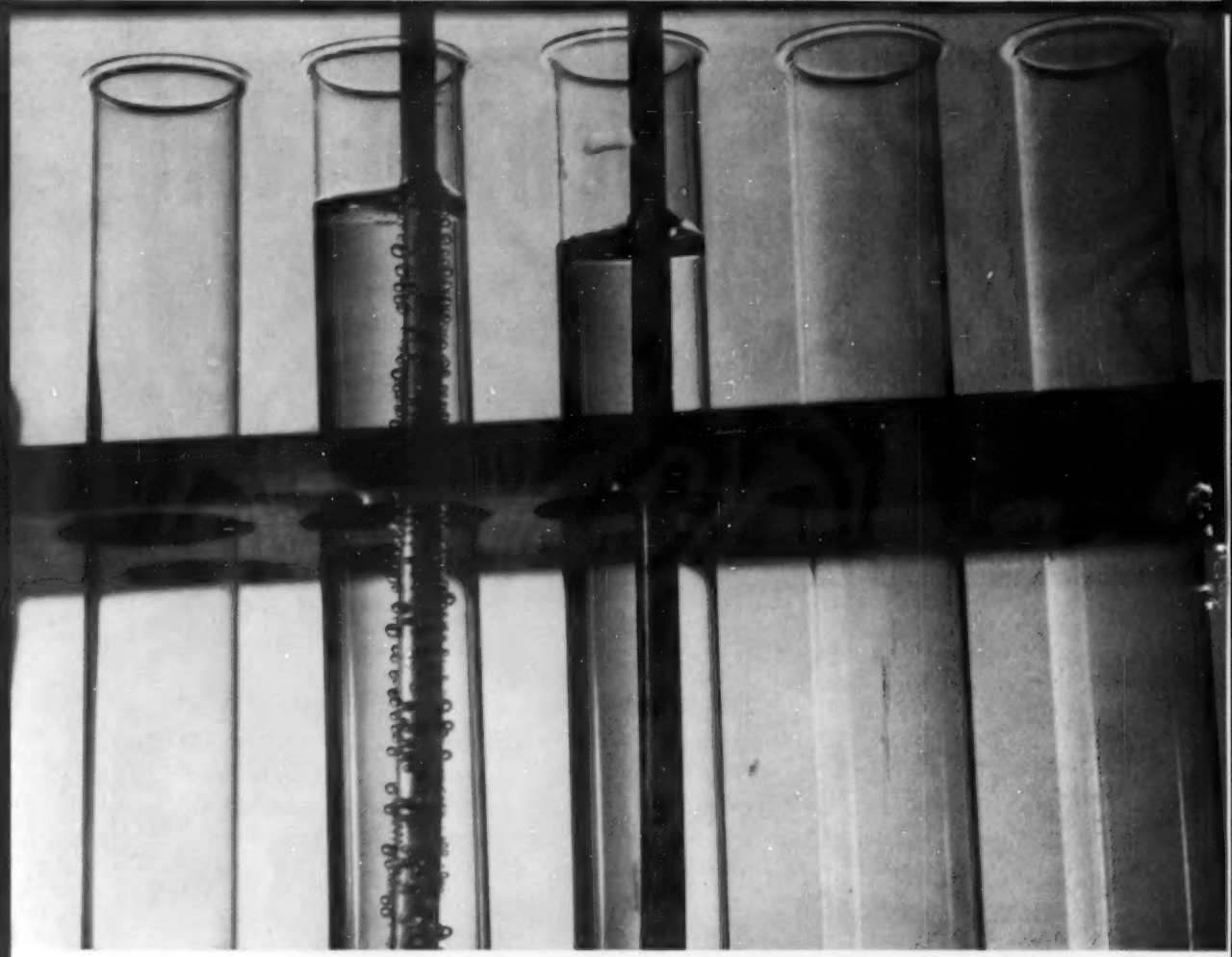
DISTRIBUTION

Design 104
Construction 97
Operation 74, 108, 113

EQUIPMENT NEWS

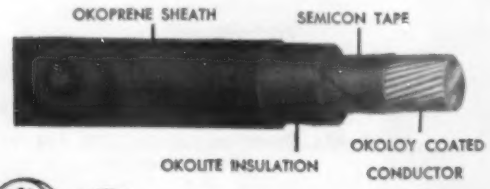
New Equipment 142
Catalogs and Bulletins 162

INDEX OF ADVERTISERS 186



Why Okoloy conductor coating outlasts "tinning" 2 to 1

The conductors above are immersed in a solution of sulphuric acid. Bare copper conductors are quickly attacked by corrosive chemicals such as sulphur acids formed when moisture combines with sulphur and sulphur compounds frequently used in the vulcanization of rubber insulations. The conductor coating must, therefore, be highly resistant to it.



The copper wire on the left is coated with tin, the most commonly-used conductor coating material. The acid attacks it immediately. The other copper wire, unaffected by the acid, is coated with Okoloy. Okoloy, a virtually pure lead coating, has been used by Okonite since 1928 to coat all copper conductors for rubber-insulated cables. Of all the common metals, lead is least affected by sulphuric acid and other corrosive chemicals. *Okoloy outlasts even the best "tinning" at least 2 to 1.*

* * *

Next time you buy a rubber-insulated cable, *make sure* the insulation and conductor are protected by Okoloy conductor coating—*not* tin.

The Okonite Company, Passaic, N. J.

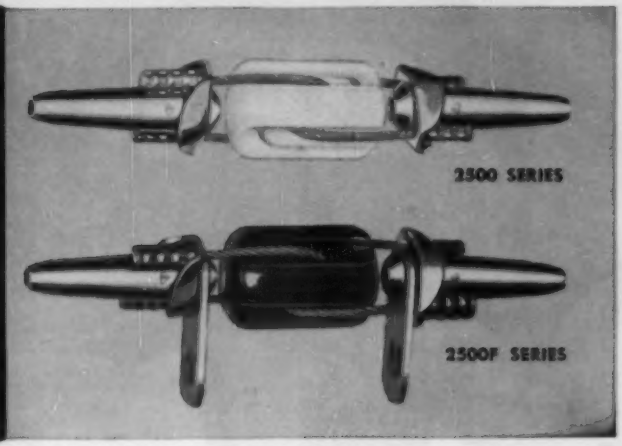
Okolite-Okoprene cables are made by the strip-insulating process

OKONITE OKONITE SINCE 1878 ***insulated cables***

2889

for the largest number of line applications at the lowest possible cost...

USE *Electroline* Insulating Automatic Line Splice SECTIONALIZERS



The Electroline Sectionalizers are assemblies that will function in service as most convenient, reliable and yet low cost interrupting devices. Series 2500-F and 2600 provide for paralleling with a fuse element for further protection when sectionalizing. The mechanical strength of these assemblies exceeds in all cases the rated breaking strength of the conductor for which they are adapted.

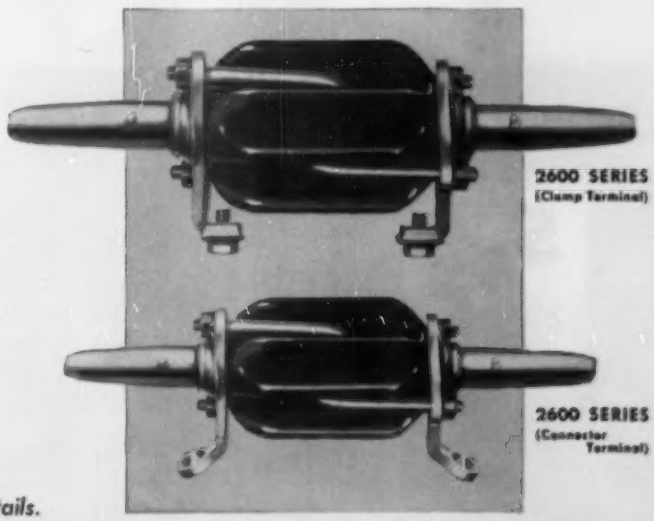
These Insulating Automatic Line Splice Sectionalizers are ideal for:

Installing Regulating Equipment,
simplifies cutting-in disconnecting points, fuses, voltage regulators and series capacitors;

Restoring Service,
providing points to test for trouble;

Sectionalizing Networks,
to readily isolate and test the area in trouble;

Series Street Lighting,
simplifies cutting-in series street lamps—merely cut the line and insert conductor ends into sectionalizer.



Send for Bulletins containing complete details.

TALENT TO ORIGINATE E ABILITY TO PRODUCE

Electroline Company

4121 South La Salle Street • Chicago 9, Illinois

In Canada: POWERLITE DEVICES, LTD., TORONTO

SWITCH YOUR DISTRIBUTION FEEDERS

The MODERN WAY

S&C

LOAD INTERRUPTER

With the S&C Load Interrupter you can just pull the handle when emergency strikes—when the line is down. You can drop the load—all of it—at once. No need to go through complicated unloading preliminaries—no need to open main breakers causing otherwise unnecessary interruptions. Outages are held to a minimum—line repairs can go forward immediately.

When you pull the handle there's no uncertainty about a successful interruption. Besides, you are safe if you open the feeder at the wrong time or at the wrong place.

The Load Interrupter makes all this possible because it can open the circuit under any condition except short circuit—and do it with *no external arc.*

AT NEW LOW COST

S&C MAKES LOAD INTERRUPTER ADVANTAGES AVAILABLE UNDER DISTRIBUTION SYSTEM ECONOMICS

LOOK AT THE PRICES

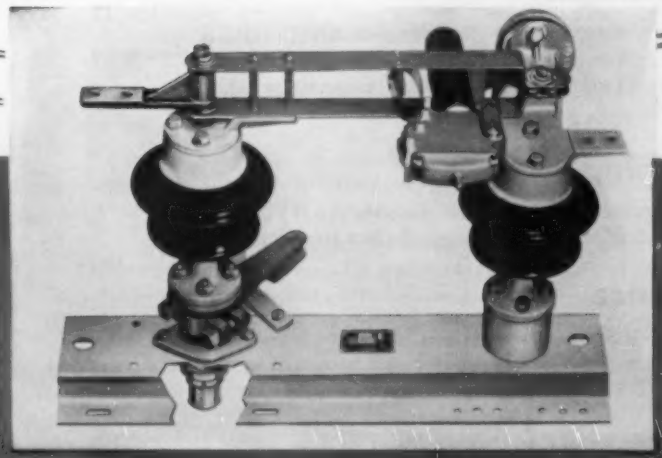
for an S&C 3-pole side-break Load Interrupter—suitable for vertical or inverted as well as upright mounting.

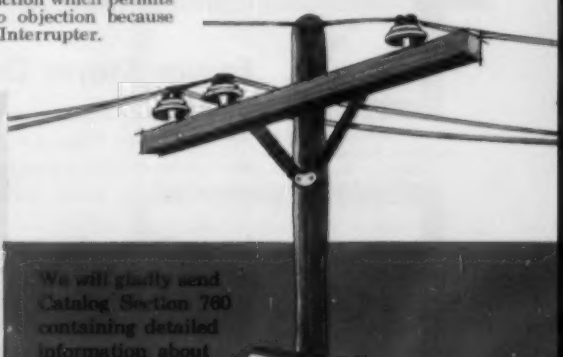
COMPARE THESE PRICES

with what you pay for conventional disconnects or horn gaps. Can you afford to go longer without the advantages of Load Interrupters on your distribution lines?

Kv	Amperes Continuous	Amperes Interrupting	Net Price
7.2	400	400	$455.00
7.2	600	600	480.00
14.4	400	400	465.00
14.4	600	600	495.00

These low prices are made possible by the side-break action which permits 2-insulator construction. Side-break action offers no objection because of the arc-free performance of the S&C Load Interrupter.





We will gladly send Catalog Section 760 containing detailed information about S&C Load Interrupters.

Specialists in High-Voltage Circuit Interruption since 1910

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

In Canada: S&C Electric Canada, Ltd., 6 Vanco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

Florida public utility crew dismantling open wires that were replaced by one self-supporting Simplex-ANHYDREX Aerial Cable (dark line running through trees).

Replace Open Wires with Simplex-ANHYDREX Aerial Cable

for . . . **Fewer Storm Outages**

Supported by copper-covered steel messengers, Simplex-ANHYDREX Aerial Cables transmit power dependably even when wind and ice send poles crashing down. The Anhydrex insulation makes these cables unequaled for water resistance.

. . . **Less Tree-Trimming**

Their extra-tough neoprene jacket makes Simplex-ANHYDREX Aerial Cables highly resistant to abrasion from chafing tree limbs.

. . . **Better Appearance**

Simplex-ANHYDREX Self-Supporting Aerial Cables free poles from crossarms and clutter. With Anhydrex insulation and neoprene jacket there is nothing to rot or fray.

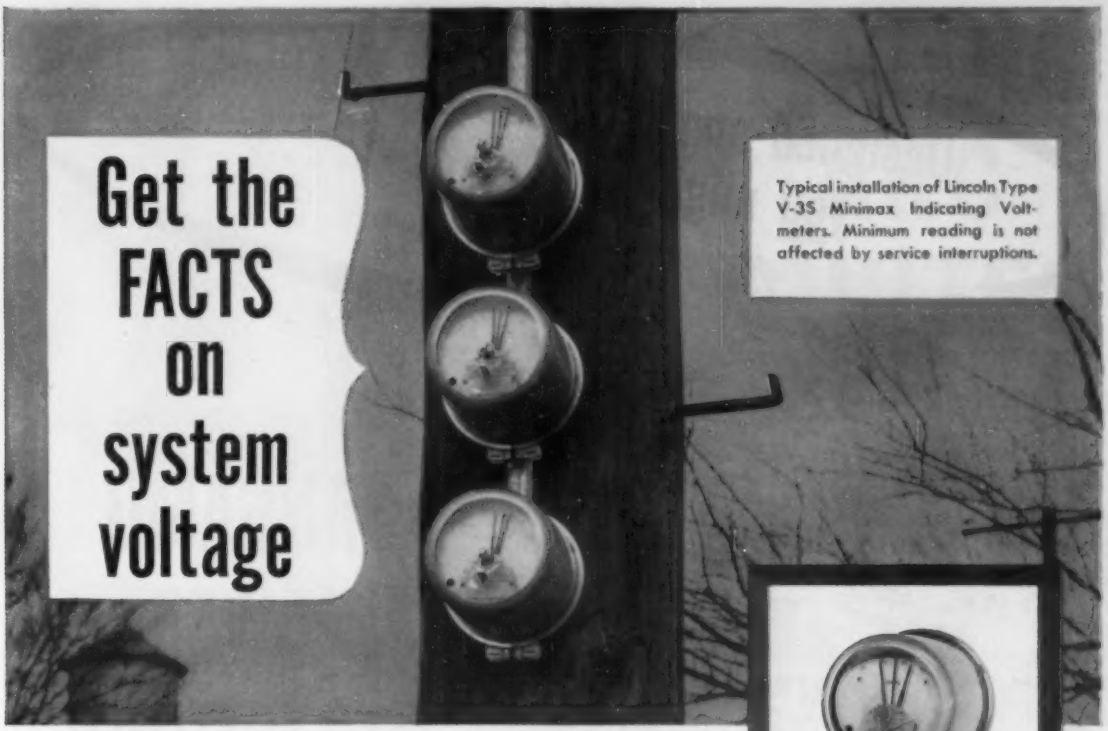
* * *

For Simplex-ANHYDREX Aerial Cable information, or details about high-quality Simplex Aerial Cables built to your specifications, write to the address below.

Simplex – ANHYDREX Aerial Cables

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Massachusetts

Get the FACTS on system voltage



Typical installation of Lincoln Type V-3S Minimax Indicating Voltmeters. Minimum reading is not affected by service interruptions.

Eliminate costly "surveys" with low-cost permanent installations of rugged LINCOLN THERMAL VOLTMETERS

Continuous knowledge of voltage at check points throughout your system lets you plan necessary changes to provide good customer service *before* difficulties develop.

Lincoln Thermal Voltmeters are an *economical* means of obtaining such knowledge—at substations—on distribution feeders—on secondaries—and even at the customer's premises. These rugged thermal voltmeters give continuous voltage data at low cost. Readings are not distorted by flicker voltage.

The line includes minimum-maximum indicating voltmeters and graphic voltmeters. It also includes an indicating voltmeter combined with a watthour meter in a single case. This combination can replace a conventional socket type watthour meter providing kwh for customer billing and exact knowledge of voltage at the service entrance. Write for complete information on the Lincoln line today.

Type V-2S Indicating Voltmeter. Used where loss of minimum voltage indication because of service interruptions is not a problem.

Graphic Voltmeter. Used where knowledge of time and duration of voltage changes is required.

Type J2WVS Combination kwhr — voltmeter. For continuous knowledge of voltage at service entrance, as well as kwh metering for customer billing.

Only Measured Facts are Known Facts

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

SM 55-2

Designed and built to specifications you might have written . . .

Power Capacitor Specifications

1. Corrosion protection – even though case finish is scratched. *
2. Solder-sealed porcelain bushings.
3. Reliable performance at low ambient temperature.
4. Suitable for vertical or horizontal mounting.
5. Low losses.
6. Low temperature rise.
7. Stability under all operating conditions.
8. Terminal connectors for either copper or aluminum.

SANGAMO POWER CAPACITORS

RATINGS

2400 Volts.....25 KVAR
7200 Volts.....25 KVAR
Singlephase.....60 Cycles

* After many talks with utility company men, we know you want your capacitor in a case having corrosion resistance that's more than just skin deep. Sangamo Diaclor Power Capacitors have a case which is metalized with pure aluminum and finished with a two-coat, baked, vinyl resin base paint. Rust and corrosion won't attack this case even if the finish is scratched through to the steel. That's because the aluminum will "sacrifice" itself before rusting occurs.

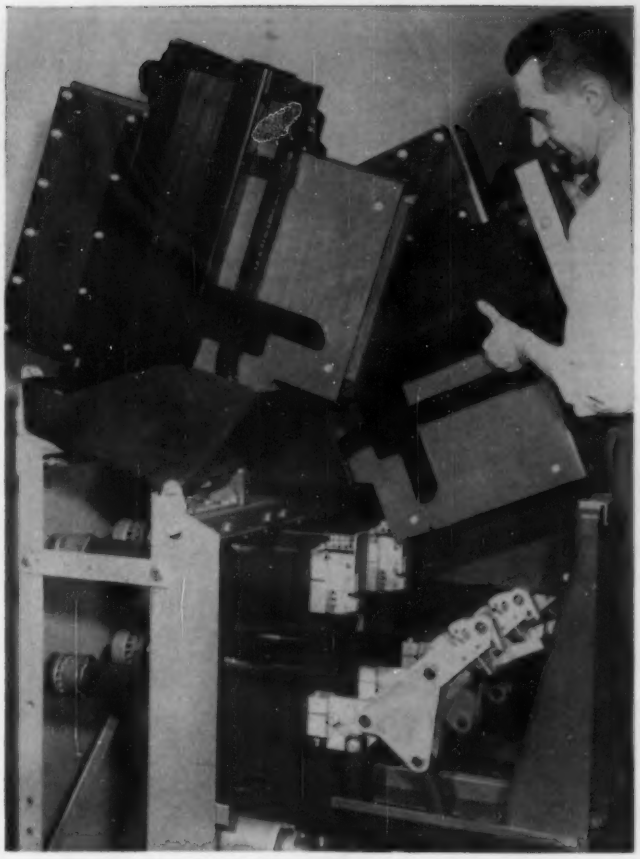
For more details on other features of the new Sangamo Diaclor Capacitor, write today for Bulletin 1120.

SANGAMO

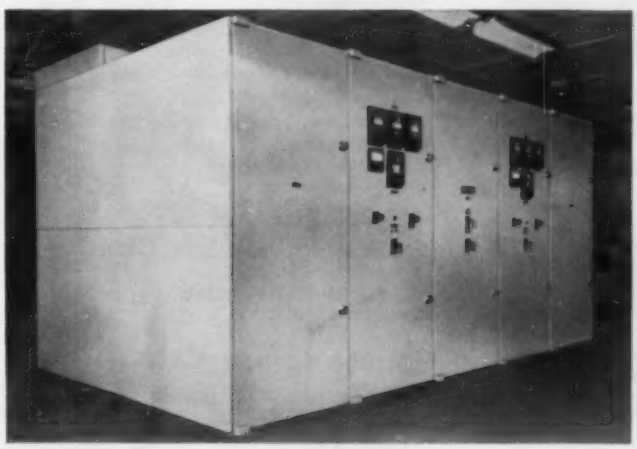
SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

PC55-3



No cranes are required. Arc chutes pivot. Rest on fixed stop. Illustration shows 15 kv magnetic air circuit breaker.



I-T-E Switchgear in 15 kv rating. All I-T-E circuit breakers are horizontal drawout, interchangeable in like ratings.

TILTING ARC CHUTES

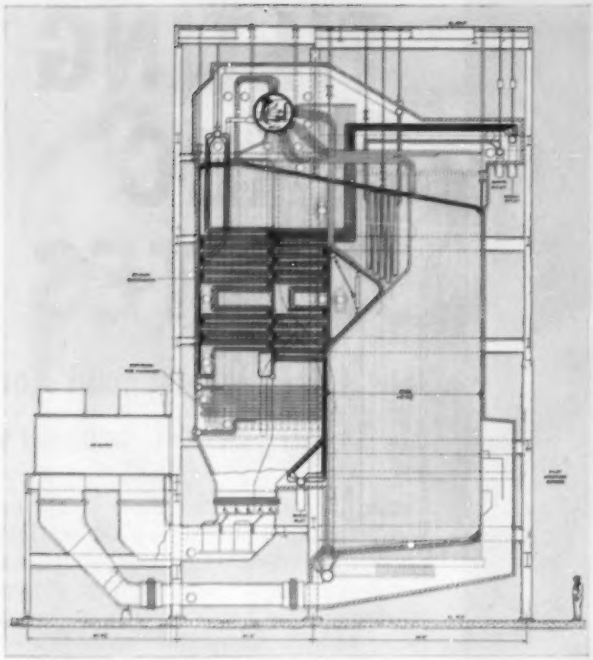
New I-T-E development for 15 kv air circuit breakers

The saving of time and effort which the new I-T-E tilting arc chutes make possible can best be appreciated by anybody who has ever removed the other kind. When inspection time comes, there's no crane lifting of heavy assemblies, no danger of dropping and damaging valuable parts. The arc chutes pivot back safely out of the way for easy inspection of contacts and arc plates. Only I-T-E makes magnetic air circuit breakers with this convenient, modern feature.

I-T-E Metal-Clad Switchgear is made in three basic ratings (5 kv, 7.5 kv and 15 kv), and will interrupt through 500,000 kva. Throughout the line, time-proved features add extra value. Circuit breakers are jig fitted to enclosures. Welded, rigid frames and housings can be lifted as a unit without losing alignment. Complete isolation of compartments insures safety and continuity of service.

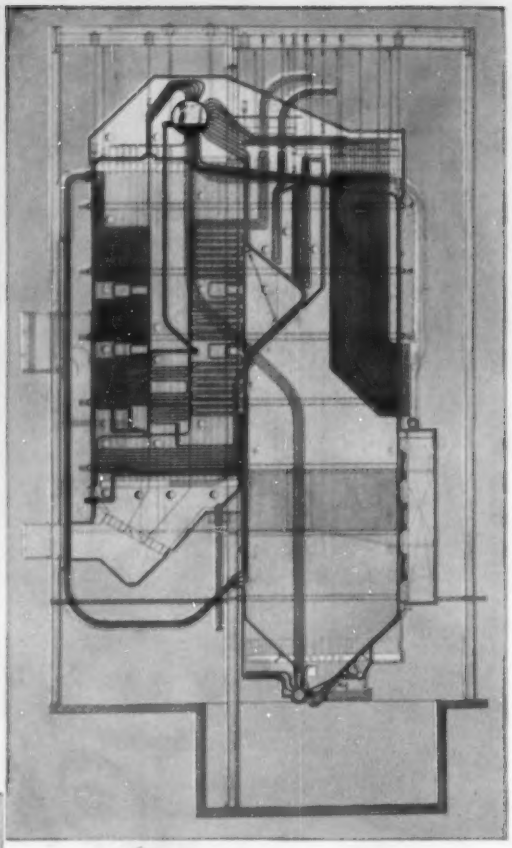
Take advantage of I-T-E planning and engineering assistance when you order switchgear. It assures you protection with economy, plus better performance. For details, contact the I-T-E field office nearest you—look in your classified directory under "Electric Equipment." Or write for Bulletin 7004C. I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Phila. 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY Switchgear Division



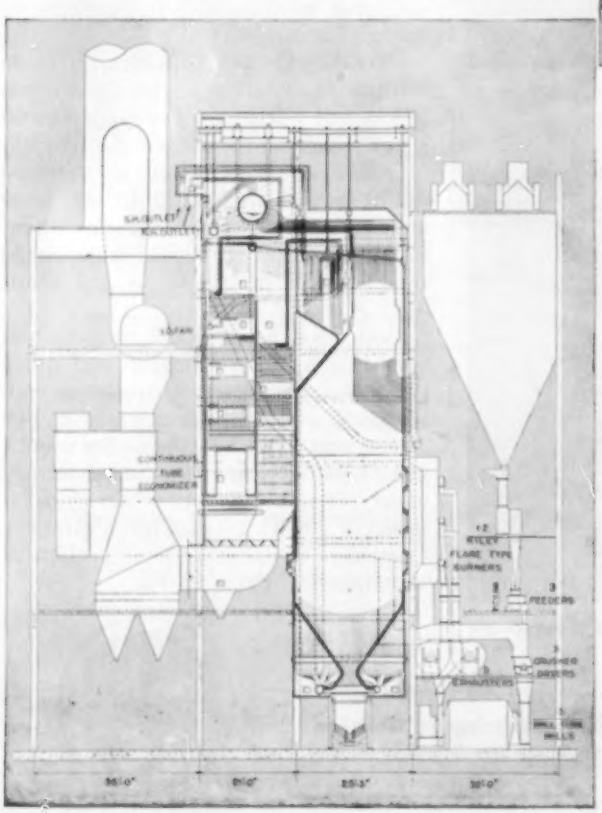
50,000 Kw

Central Louisiana Electric Co.
Teche Station, Baldwin, La.
Capacity 350,000 lbs/hr; 1500 psig; 1005F/1005F
Fuel: Natural gas; Pressurized Furnace



75,000 Kw

Florida Power Corp.
Ellaville, Florida
Capacity 600,000 lbs/hr; 1550 psig; 1000F/1000F
Fuel: Oil and Future Coal; Pressurized Setting



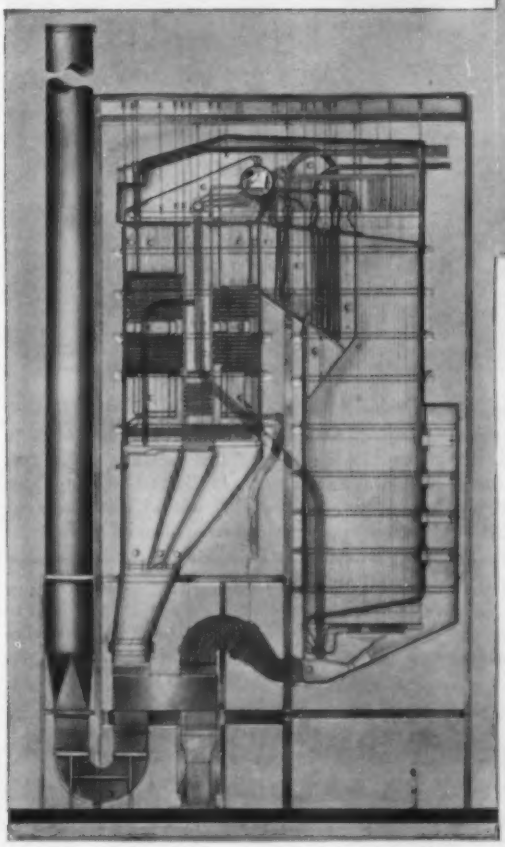
100,000 Kw (Not illustrated)
Central Illinois Light Co.
R. S. Wallace Station, E. Peoria, Illinois
Capacity 690,000 lbs/hr; 1650 psig; 1000F/1000F
Fuel: Pulverized Coal

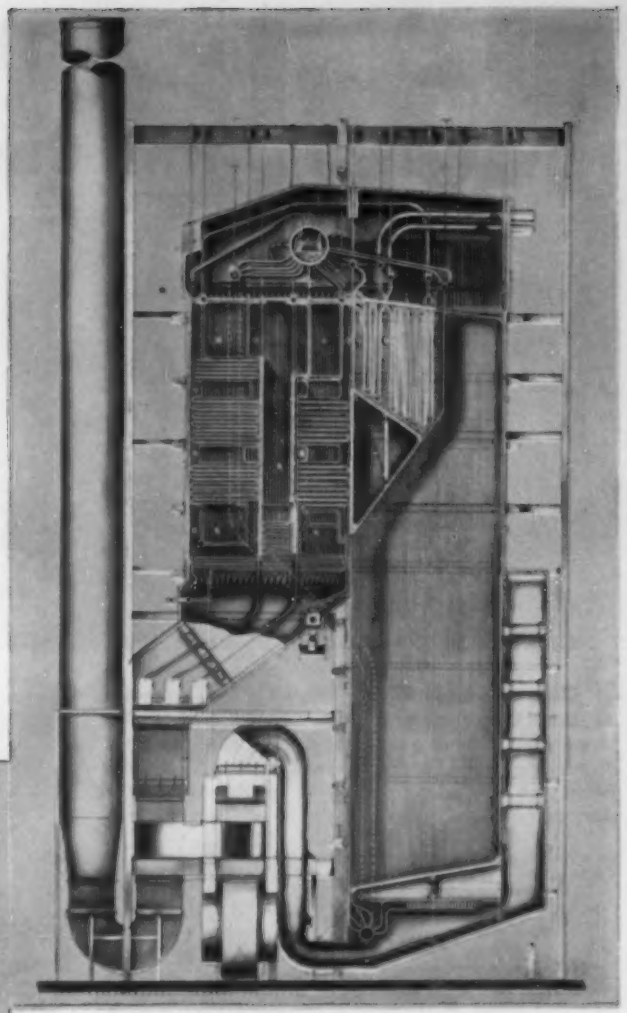
125,000 Kw
Public Service Co. of Indiana, Inc.
Wabash River Station
Capacity 805,000 lbs/hr; 2075 psig; 1005F/1005F
Fuel: Pulverized Coal

150,000 Kw (Not illustrated)
Public Service Co. of Indiana, Inc.
New Albany Station, (2 units-total-300,000 Kw)
Capacity 1,000,000 lbs/hr; 2075 psig; 1005F/1005F
Fuel: Pulverized Coal; Pressurized Furnace

125,000 Kw
Louisiana Power & Light Company
Nine Mile Point Station.
1,000,000 lbs/hr; 1725 psig; 1005F/1005F
Fuel: Natural gas; Pressurized Furnace

RILEY
Reheat Units for Turbine Ratings from 50,000 Kw up to 175,000 Kw





175,000 Kw
Houston Lighting & Power Company
Deepwater and Sam Bertron Steam Electric Stations
Capacity 1,250,000 lbs/hr; 2125 psig; 1005F/1005F
Fuel: Natural gas; Pressurized Furnace

A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.

RILEY
Stoker Corporation
WORCESTER, MASSACHUSETTS

Sales Offices: Worcester, New York, Philadelphia, Buffalo, Washington, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Houston, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.

Now! Do All Three Clearing Jobs with One HOMELITE Chain Saw

New Versatile Attachments for Model 17 Chain Saw Will Clear Everything from Brush and Brambles to Four-Foot Trees. Save Money on Equipment and Job Time by Following These Three Steps:

1 Clean Out Underbrush — Attach the new Homelite Brush Cutter to your Model 17 Chain Saw . . . in minutes. Perfect balance makes it a cinch to operate. Clears dense undergrowth, brush and small saplings four times faster than hand-clearing methods. Friction-free flexible shaft delivers full 3.5 horsepower to 10-inch circular saw.

2 Clear Small Trees and Saplings — In a jiffy the new Homelite Clearing Attachment converts your Homelite Model 17 Chain Saw to a fast-cutting, light-weight clearing tool. Plunge cuts or plunge bucks and makes limbing an easy job. Open guide rail prevents pinching and binding . . . takes the backache out of knocking the small ones down and cutting them up for haulage.

3 Now For The Big Stuff — With the standard guide bar you can bring down trees over four feet in diameter. The Homelite Model 17 is light in weight, easy to handle and packed with more horsepower per pound than any other one-man chain saw ever developed. (3.5 hp — 22 lbs.)

With its new attachments the Homelite Model 17 Chain Saw will give you the versatile, fast-cutting, dependable performance you need to save time and make real profits from clearing. Ask your Homelite Representative for a free demonstration or write for information.

PERFORMANCE · DEPENDABILITY · SERVICE

HOMELITE
CORPORATION
6108 RIVERDALE AVENUE • PORT CHESTER, N. Y.
Carryable Pumps • Generators • Blowers • Chain Saws

THERE'S ONLY ONE OIL "just as good"

When you're offered substitutes for Gargoyle D.T.E. Oils, remember these facts—

We're mighty proud that, so many times, you're told some other oil is "just as good as Gargoyle D.T.E." This is high praise—additional proof that Gargoyle D.T.E. hydraulic oils set the *standard of performance* in their field!

Gargoyle D.T.E. oils are uniformly high in quality—have been continuously improved for over 60 years to meet advanced machine designs. Premium products, their initial cost is only slightly higher than ordinary oils—often only about *one mill per hour* of machine operation!

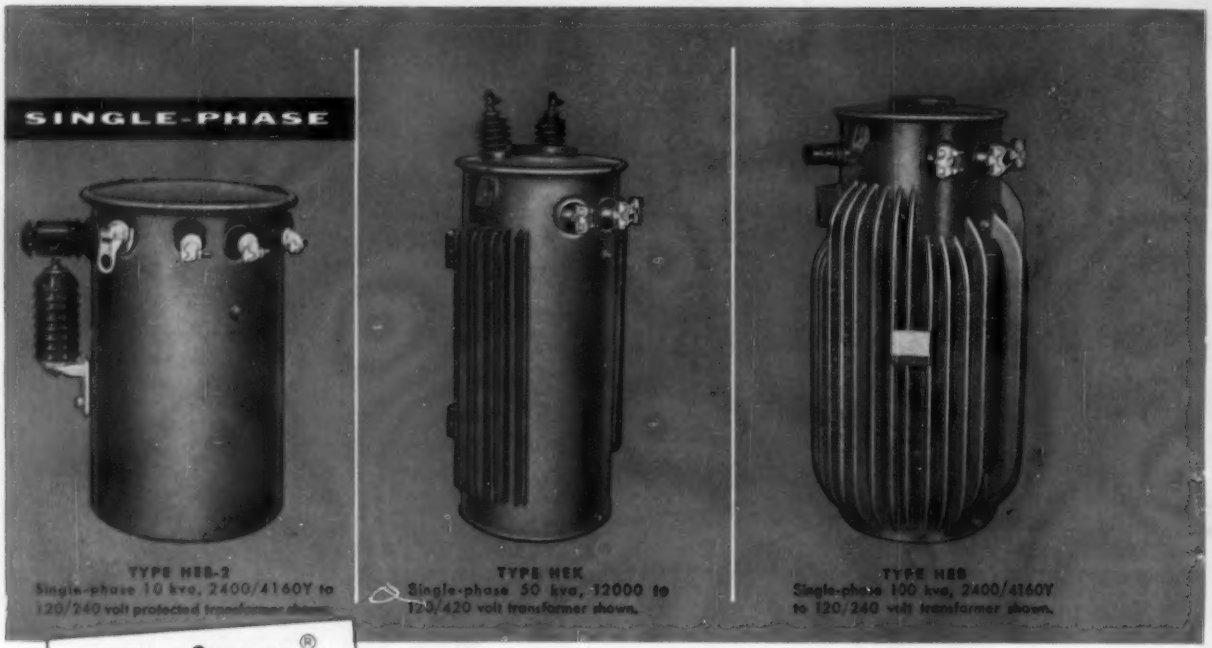
Actually, Gargoyle D.T.E. hydraulic oil is more economical in the long run because... 1) it lasts longer—has stayed in service for thousands of hours in many cases... 2) increases machine efficiency... 3) improves production... 4) reduces manufacturing costs.

Remember, too, you get the world's greatest lubrication engineering service—*at no extra cost*—when you insist on Gargoyle D.T.E. oil. Why accept less? Call us today!

SOCONY MOBIL *Correct Lubrication*

FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION
Formerly Socony-Vacuum Oil Company, Inc.


SINGLE-PHASE
TYPE HSB-2
Single-phase 10 kva, 2400/4160Y to 120/240 volt protected transformer shown.
TYPE HEK
Single-phase 50 kva, 12000 to 120/420 volt transformer shown.
TYPE HSB
Single-phase 100 kva, 2400/4160Y to 120/240 volt transformer shown.

Wagner®
TRANSFORMERS
... the choice of leaders in industry

When it comes to

WAGNER WILL MEET YOUR REQUIREMENTS!

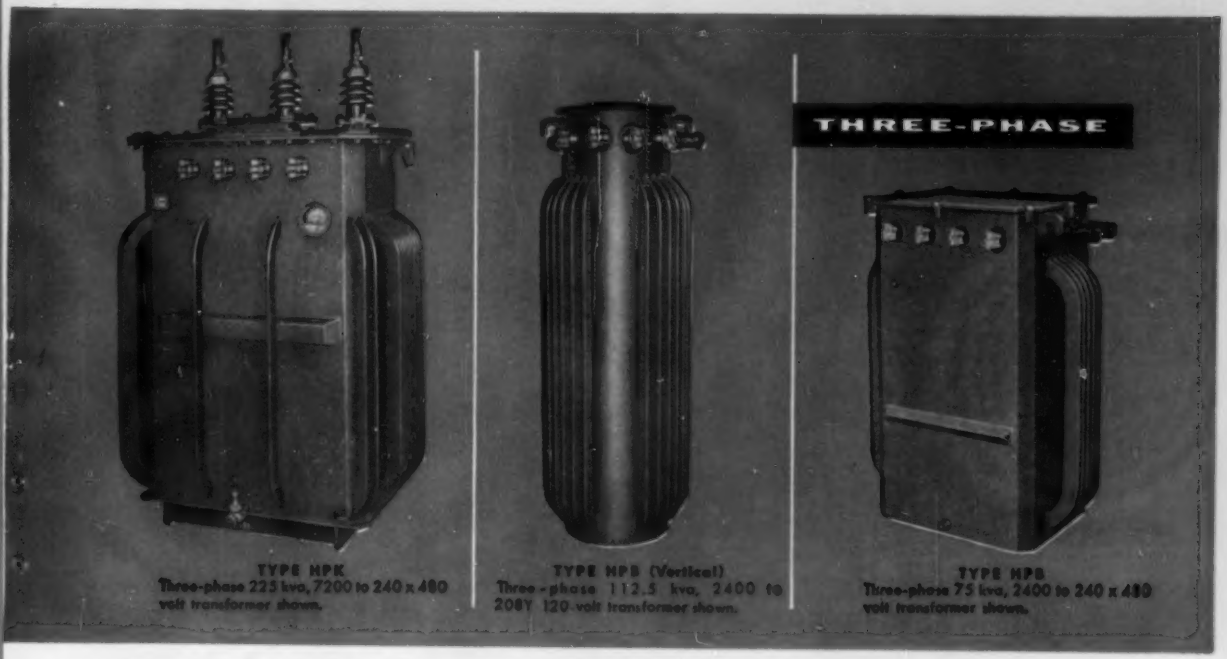
The Wagner line of Distribution Transformers, that meets *all* EEI-NEMA Standards—will also meet *all your* requirements, no matter how varied they may be. Wagner Distribution Transformers are available in all standard kva ratings and voltages.

If you want a 3 kva, pole-type transformer—Wagner has it. If you want a 150 kva, vertical-type transformer, Wagner has it, too. But these are requirements more in the nature of specifications. We're sure you have *other* requirements for the transformers you buy—such as dependability . . . long service-life . . . maintenance-free performance. Setting high standards for quality materials and careful workmanship are *additional* requirements met by Wagner Distribution Transformers.

Then there are the *extra* features of Wagner Distribution Transformers . . . like the Wagner Shur-Seal Clamping Ring, the high voltage side-wall bushing, the locked low voltage bushing and the Wagner Form W element. *All* Wagner Distribution Transformers are filled with inhibited oil to reduce oxidation and retard the formation of acids and sludge.

You get quick delivery, too. Wagner's expansion program has provided a new plant, devoted exclusively to the manufacture of transformers, to help meet the growing demand for Wagner Transformers. In addition, Wagner has a nation-wide organization to provide fast, convenient service—with branches in 32 principal cities.

Get in touch with your nearby Wagner branch today. Write for your copy of Bulletin TU-180. It gives complete information on Wagner Distribution Transformers.



TYPE HPK
Three-phase 225 kva, 7200 to 240 x 480 volt transformer shown.

TYPE HPB (Vertical)
Three-phase 112.5 kva, 2400 to 208Y 120-volt transformer shown.

TYPE HPB
Three-phase 75 kva, 2400 to 240 x 480 volt transformer shown.

Distribution Transformers...

HIGH VOLTAGE SIDEWALL BUSHING

This high voltage sidewall bushing permits *faster* connections because the conductor is simply pushed into the connector and tightened with a few turns of the knob... *easier* because no tools are needed... are *safer* because the knurled knob is insulated to protect the lineman from accidental shock.

LOCKED LOW VOLTAGE BUSHING

These bushings are keyed to prevent rotation. The porcelain is keyed to the tank and the metal stud is keyed to the porcelain. There can be no loose connections on the inner end of the terminal studs because it is impossible for these studs to turn when the terminals are being tightened.

SHUR-SEAL COVER

Covers of pole-type transformers with round tanks are sealed to the tank with the Wagner Shur-Seal Clamping Ring. "Breathing" is completely prevented and no loss of oil can occur at any time. The Shur-Seal ring maintains equal pressure all around the cover—yet the cover may be easily removed by loosening a single, stainless steel bolt.

Wagner FORM W ELEMENTS

All Wagner single-phase distribution transformers in ratings 500 kva, 15 kv and below, are furnished with Wagner Form W core and coils which permit a liberal design in small size, lightweight transformers and which give excellent electrical performance.

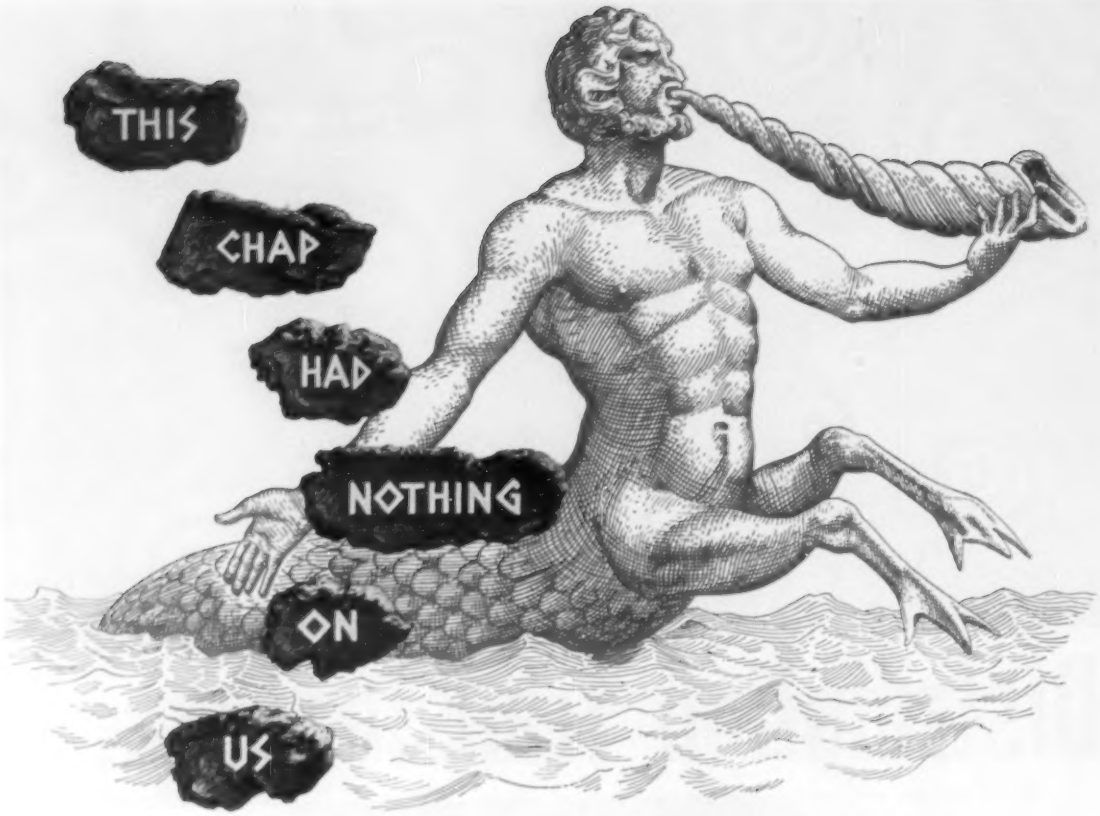
T55-6

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave. • St. Louis 14, Mo., U. S. A.

Wagner Electric Corporation
EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES



He's Proteus, Neptune's son, a highly versatile character—hence the adjective *protean*. You never knew whether next you'd see him as a lion, a raging fire, a reptile, or an angry bull.

Here at Driver-Harris, we do protean marvels too . . . with *metals*. For instance, Nichrome*, the unique heat-resistant, corrosion-resistant, electrical-resistance alloy known the world over, has long been the engineer's yardstick of comparison not in one, but *in at least 3 widely different applications.*

TO GENERATE HEAT: In all applications of producing heat by electricity, particularly to temperatures above 1700°F., Nichrome and Nichrome V set the quality standard. From simple electrical appliances such as ranges, broilers, toasters, etc. to giant industrial furnaces, no other alloys enjoy such widespread recognition and use.

TO RESIST HEAT: Because of its unsurpassed resistance to heat and corrosion, Nichrome is used for making massive furnace muffles and retorts often weighing tons, and work-loading fixtures of all shapes. The outstanding property of Nichrome here is its extremely long life, which results in low heat-hour costs.

TO RESIST ELECTRICITY: The greatest contribution to outstanding stability and miniaturization of resistors is made by Nichrome wire. Drawn to sizes as small as .0005 and finished in a variety of insulations, Nichrome is a boon to electronics in the manufacture of high tolerance resistance units of all types.

Added to the nickel and chrome of Nichrome and Nichrome V is always one exclusive ingredient—the supreme mastery of the Driver-Harris specialists, gained in their 57 years of melting and drawing experience.

In recognition of its unique properties, the United States Patent Office in August, 1908, granted solely and exclusively to us the trademark NICHROME. There is *only* one Nichrome, and it is made only by Driver-Harris.

*T. M. Reg. U. S. Pat. Off.

Driver-Harris Company HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Louisville, Los Angeles, San Francisco

In Canada: The B. GREENING WIRE COMPANY, Ltd., Hamilton, Ontario

MAKERS OF THE MOST COMPLETE LINE OF ELECTRIC HEATING, RESISTANCE, AND ELECTRONIC ALLOYS IN THE WORLD

Pennsylvania Transformer Company

invites you to meet the ALL NEW

P.S. PERFECT SEAL

Pole Star

DISTRIBUTION TRANSFORMER

★ NEW in concept
★ NEW in design
★ UNMATCHED in performance

An exclusive development of
Pennsylvania Transformer Company's
Advanced Engineering Department

pt

PENNSYLVANIA TRANSFORMER COMPANY
A McGraw Electric Company Division
CANONSBURG, PA., Greater Pittsburgh District

PENNSYLVANIA
PERFECT SEAL

Pole Star

DISTRIBUTION TRANSFORMERS

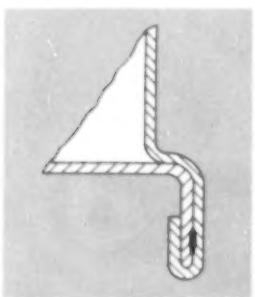
soon available in sizes

5-10-15-25 Kva • without taps • 2400 Volts through 14,000 Volts

In recent years, there has been a decided trend toward completely-sealed transformers. Many present-day power and network transformers are manufactured with welded covers and soldered bushings. Up to now, however, true sealed construction has not been applied to pole-type distribution transformers. Although the various methods of bolting and clamping covers and handholes can produce effective seals at the factory, when transformers are opened by the user there is no way of accurately determining if the transformer is again perfectly sealed. A half-turn of a nut or screw can destroy an effective seal and allow restricted breathing. This permits moisture to be drawn into the tank, where it becomes condensed and remains to possibly weaken the dielectric strength of the windings and oil. Failure of the transformer can result.

To correct this situation, Pennsylvania Transformer Company engineers have developed the Perfect Seal POLE STAR, a no-tap transformer which is completely and perfectly sealed to provide permanent protection to the transformer. All openings between cover and tank and between bushings and cover are permanently sealed by metallic fusion. Complete electrical tests are made to certify the performance of each transformer. Thus, there is no need for opening the Perfect Seal POLE STAR for inspection or testing prior to placing it into service.

Tooling and preparations for production are now being made, and Pennsylvania Transformer Company anticipates that Perfect Seal POLE STAR transformers will be available in a few months.



Cross section view of tank bottom shows how tank sidewall curls around bottom plate to form a sturdy triple-wall base. The seal is made oil-tight by resistance welding.

Guide bars position core and coil assembly in tank. Bottom section of core frame is "dimpled" to engage embossing in bottom of tank. Cover is permanently fixed to core frame and cannot turn.

Cover and Core and Coil Assembly are permanently joined to form an integral unit which fits into tank.

The Perfect Seal POLE STAR will capture your imagination and win your admiration with outstanding advanced features like these:

- ★ tank cover and all fittings permanently and perfectly sealed by metallic fusion
- ★ core frame welded and riveted (no bolted connections)
- ★ lead support riveted to core frame (no bolted connections)
- ★ all electrical connections crimped or brazed
- ★ all cover clamps and lift lugs eliminated from tank (transformer lifted by eye bolt in center of cover)
- ★ all bushings—high and low—mounted in the cover
- ★ patented "lap-on-top" core construction assures low exciting current and low core loss
- ★ new improved coil construction assures better regulation
- ★ small size and light weight

The Perfect Seal Pole Star is Permanently and Perfectly Sealed by metallic fusion

to keep out { air and water

to keep in { low power factor and high dielectric strength

If it's Permanently Sealed, it's a PERFECT SEAL

P.S. Pole Star

pt

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division • CANONSBURG, PENNSYLVANIA

Production line IMPULSE testing is your guarantee that Perfect Seal POLE STAR transformers will never have to be opened.

Every Perfect Seal POLE STAR transformer is impulse-tested to make absolutely certain that it *can* remain sealed throughout years of high-efficiency service. Impulse testing is performed after the units have passed all required ASA and NEMA tests — with each transformer being subjected to impulse voltages that are in accordance with the basic impulse insulation levels required by ASA and NEMA standards.

Since tests are made between layers and turns as well as to ground, these impulse tests simulate the impulse surge conditions likely to occur throughout the entire transformer during actual service. The apparatus used for detecting failures is so sensitive that it will disclose *even* a one-turn high voltage short circuit.

Pennsylvania Transformer Company presents an All-New, All-Steel Shipping Drum with the All-New Perfect Seal POLE STAR.

You'll like the added protection, plus the other advantages, of these new all-steel shipping drums. They'll keep your Perfect Seal POLE STAR transformers *factory fresh* inside and out . . . during shipment and handling as well as during storage indoors and outdoors. The drums are designed to simplify handling and stacking, and to conserve valuable space . . . features you can take advantage of *all the way to the installation site.* Afterwards, of course, you will find dozens of uses for the empty drums . . . in your warehouses, sub-stations, pole yards, and office buildings. Also, all-steel drums eliminate the fire hazard and disposal problem common to ordinary wooden and fibre shipping crates. In short, you get protection *plus* with the Perfect Seal POLE STAR'S all-new, all-steel shipping drums.

POLE STAR

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division • **CANONSBURG, PENNSYLVANIA**

PS655

THE GREATEST NAME IN ELECTRICAL WIRE AND CABLE

General Cable has pioneered in the research and quality-controlled manufacture of Service Drop Cables. Down through the years their extremely high uniformity and dependability have gained an outstanding reputation.

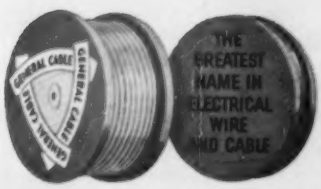
Examples of the more popular types are:

Service Drop Aerial Messenger Types are available in constructions consisting of one, two or three insulated conductors twisted around a bare messenger. *Conductors* in aluminum or copper. *Insulations* are available in neoprene, polyethylene, or rubber and neoprene. *Messengers* are available in aluminum, ACSR, copper, copperweld, or copper-copperweld.

Service Drop Type SD is available in either aluminum or copper conductors . . . with one insulated conductor, or two parallel insulated conductors with concentric uninsulated neutral conductor . . . flame-and-moisture-resistant covering.

See your friendly General Cable Representative for complete listings and more details.

GENERAL CABLE
CORPORATION



BARE, WEATHERPROOF, INSULATED WIRES and CABLES FOR EVERY ELECTRICAL PURPOSE

GENERAL CABLE CORPORATION
Executive Offices: 420 Lexington Ave., New York 17, N. Y.

SALES OFFICES: Atlanta • Baltimore • Boston • Buffalo Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit Erie (Pa.) • Greensboro (N. C.) • Houston • Indianapolis Kansas City • Lincoln (Neb.) • Los Angeles • Memphis Milwaukee • Minneapolis • New Haven • Newark (N. J.) New York • Philadelphia • Pittsburgh • Portland (Ore.) Richmond (Va.) • Rochester (N. Y.) • Rome (N. Y.) St. Louis • San Francisco • Seattle • Springfield (Ill.) Syracuse • Tampa • Tulsa • Washington, D. C.

FEDERAL MICROWAVE—"CERTIFIED BY A WORLD OF RESEARCH"

Peak performance for your communication needs

Whatever the voice, message, and signal circuits your industry needs for the transmission of its operating intelligence, a *Federal* multichannel microwave system can provide them... completely... continuously... simultaneously... and with topmost dependability.

Federal Microwave has a built-in record of quality and performance that is unique in the field... a record of progress that reaches back to the birth of the art... to the world's *first* commercial microwave link... inaugurated decades ago by companies of International Telephone and Telegraph Corporation.

Today, the work of extending the applications and efficiency of IT&T's preeminent microwave techniques goes on endlessly... in laboratories and factories in the United States and nine foreign lands. An important contributor to this continuing program is *Federal's* own forty-odd years in electronics.

It is this background... this *pioneering* spirit... that keeps *Federal* Microwave outstanding for its *peak* performance... distinguishes it as the microwave system that's *"Certified by a World of Research!"*

Federal

A DIVISION OF I T & T

Federal Telephone and Radio Company

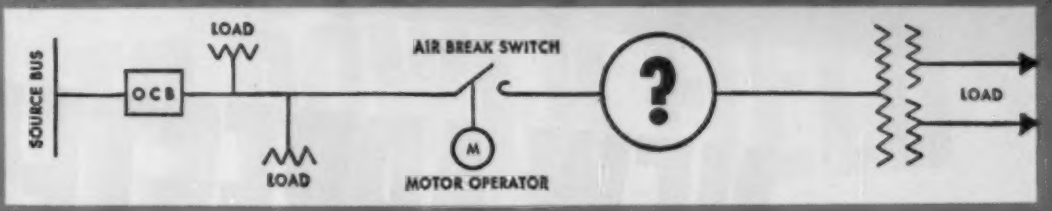
A Division of INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

100 KINGSLAND ROAD • CLIFTON, NEW JERSEY

In Canada: Standard Telephones and Cables Mfg. Co. (Canada) Ltd., Montreal, P.Q.

Export Distributors: International Standard Electric Corp., 67 Broad St., New York

HOW WOULD YOU PROTECT THIS TRANSFORMER?



SOUTHERN STATES TYPE HRS SAVES COST OF EXPENSIVE OIL CIRCUIT BREAKER

The problem presented in the schematic diagram above is to provide adequate internal fault protection for a power transformer. One solution would be to install a high side oil circuit breaker. However, this represents a large capital outlay—and, under many conditions, might not be justifiable.

The most practical solution would be to use the source breaker to clear the line should a damaging fault condition develop in the transformer; however, in the above case, transformer impedance is great enough to limit current to values below trip settings for the source breaker relays.

The answer is to install Southern States Type HRS Automatic High Speed Short Circuiting Switch. As soon as such a fault condition develops, the Type HRS, tripped by differential relays, imposes a deliberate ground fault on the line. The source breaker opens, clears the line, and the transformer is protected.

In order to isolate the transformer from the feeder, it is customary to install an air switch on the feeder between the short circuiting switch and the source breaker. Service continuity on the remainder of the feeder, after the HRS operates, can be maintained by providing the air switch with a spring or motor operator. Suitable under-voltage timing relays will automatically open the air switch during a delayed breaker reclosure, restoring service to the line at once.

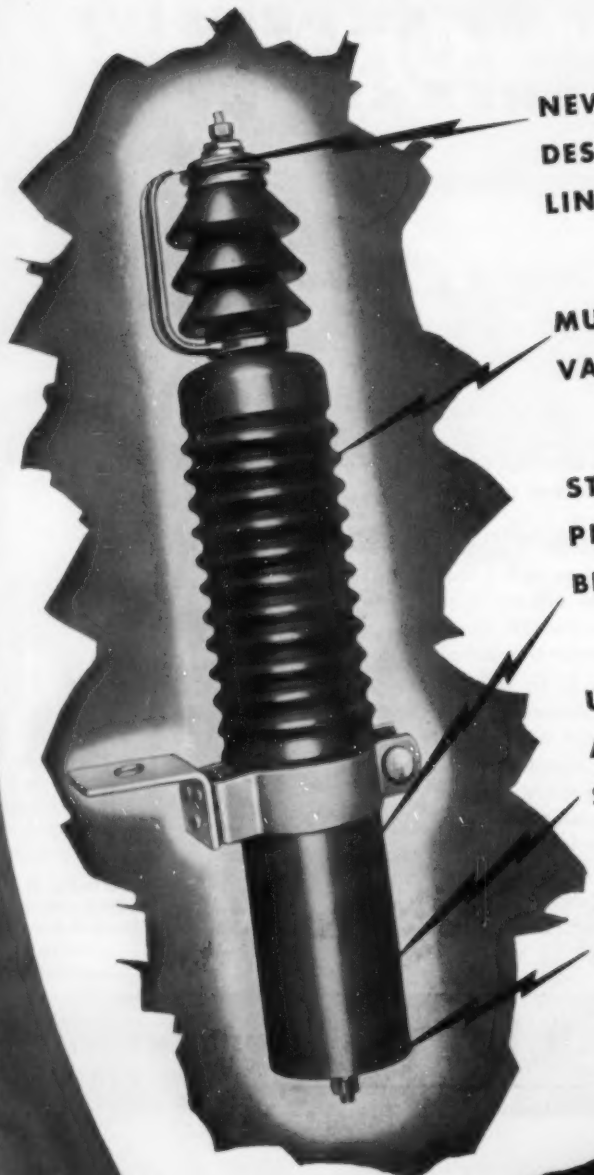
For a low capital investment and reliable protection, choose the Type HRS. Complete details are available in Bulletin 55 HRS.

Available in Voltage Ratings of 34.5 KV through 161 KV and momentary current ratings of 20,000 amperes and a 4-second rating of 12,600 amperes.

SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

NEW ARRESTER



NEW EXTERNAL GAP DESIGN ELIMINATES LINE LOCK-OUT

MULTI-PATH CRYSTALLITE VALVE ELEMENT

STREAMLINE HOUSING PERMITS EASIER MOUNTING OF BRACKET DURING INSTALLATION

ULTRA-SPEED MULTIPLE ARCING UNIT FOR SPLIT SECOND PROTECTION

VENTED OR NON-VENTED TYPES

HITS POWER FIELD

EXTERNAL GAP ARRESTER ELIMINATES LINE LOCKOUT

Now, from the laboratories with more than a half-century of experience in developing and producing the newest and finest in lightning protection, comes the ultimate in arresters. The new distribution type Crystal Valve Lightning Arrester with isolating line gap.

This new arrester is the result of Electric Service development and field engineers taking all of the finest, service-proved features of Crystal Valves . . . putting them into one arrester . . . and adding a feature sought by thousands of utility men. It is a distribution valve type arrester with an external isolating line gap, available in 9 KV and 10 KV maximum permissible line to ground voltage rating. The improvement of the addition of the isolating gap feature is accomplished without added length over that of the present stud type arrester.

Designed especially for cross arm mounting these new distribution type Crystal Valve Lightning Arresters with isolating line gap offer new and positive protection and are available in both the vented and non-vented internal spark gap construction. Write for additional information on this newest development of Electric Service engineers to Dept. CVI.

ELECTRIC SERVICE MANUFACTURING COMPANY
PHILADELPHIA 32, PENNSYLVANIA

NEW 7½-acre plant (under one roof)
to provide
faster service for those who use...

WIRE BY PHELPS DODGE

Huge wire mill-warehouse offers immediate delivery service on wire and cable!

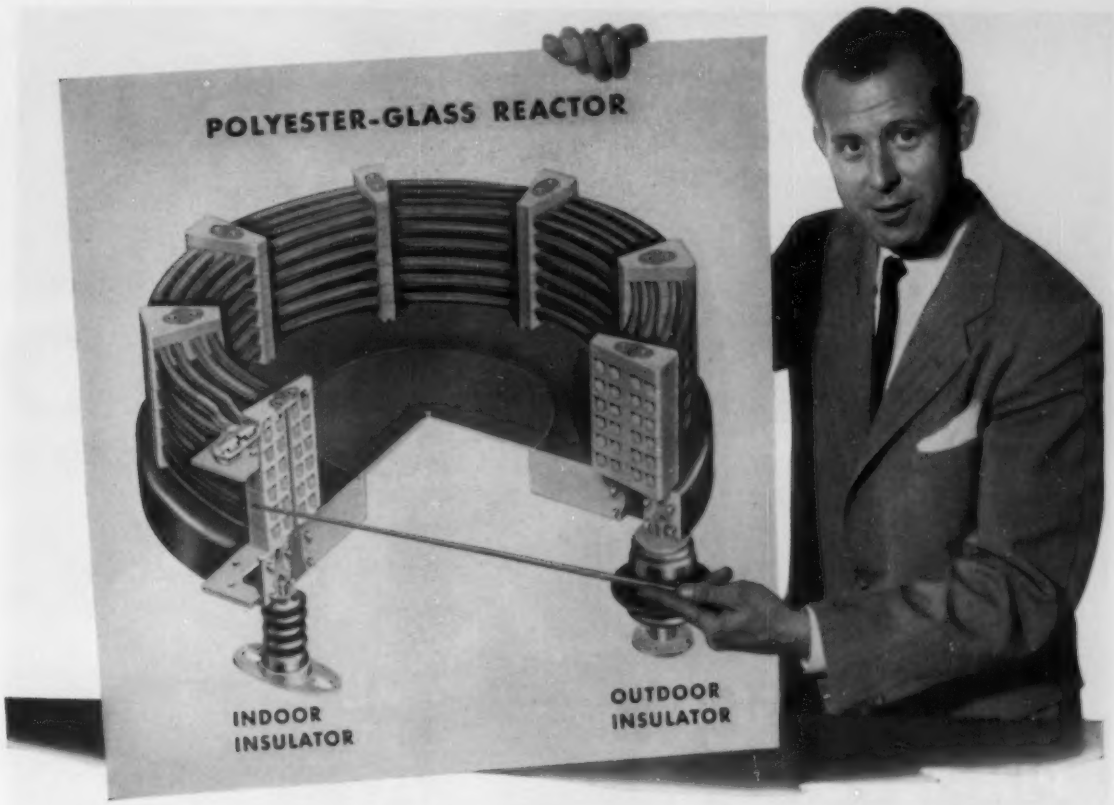
Phelps Dodge Copper Products Corporation's new plant at Yonkers, N. Y., covers seven and a half acres, is equipped with the latest facilities to service its customers.

A coordinated production and warehousing system in this plant enables Phelps Dodge to maintain stocks of every kind of building wire and cable ready for immediate filling of customer orders. Ten truck bays and a seven-car undercover freight siding will eliminate the usual loading delays, help speed shipments to their destinations. This new and exclusive system is an example of the careful attention Phelps Dodge has given to providing the finest service for its customers at this new plant.

On every wiring job, large or small, where top quality materials, expert workmanship and experienced "know-how" are called for, *it pays to rely on Phelps Dodge and your Phelps Dodge* distributor!

PHELPS DODGE COPPER PRODUCTS CORPORATION

SALES OFFICES: Atlanta, Birmingham, Ala., Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Fort Wayne, Greensboro, N. C., Houston, Jacksonville, Kansas City, Mo., Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Roanoke, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.



"Ageless" materials make new reactor stronger, lighter, more durable

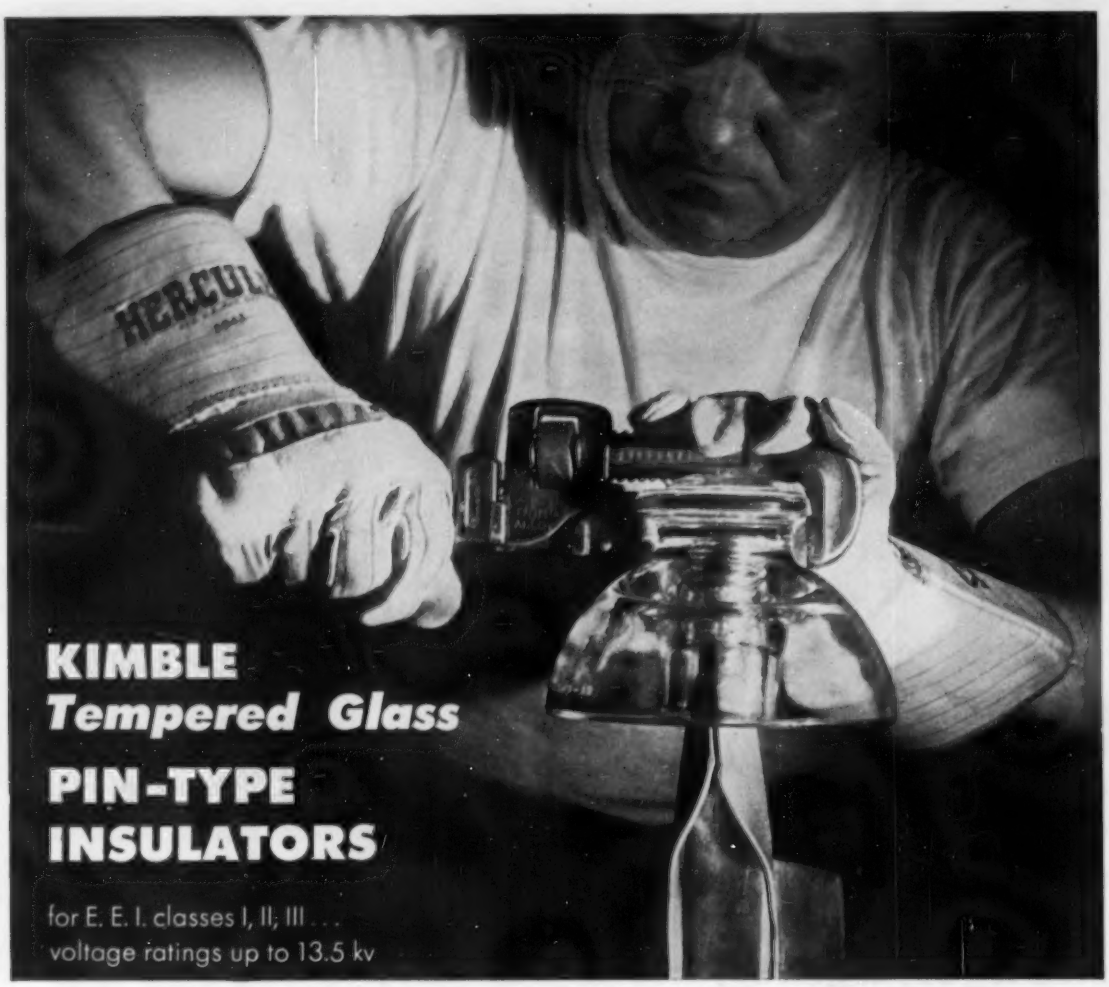
The news in the new line of Westinghouse current-limiting reactors is a polyester glass that is stronger and lighter by far than any material used before in reactor construction. This polyester not only solves the aging and maintenance problem, but also permits a 30% reduction in reactor size and weight.

This new material provides these outstanding characteristics: (1) Exceptional mechanical and electrical strength—3 times the compressive strength and 10 times the tensile strength of concrete. (2) Great resilience to thermal and mechanical shocks—will withstand the forces generated by heavy short circuits and expansion of conductors during overloads. (3) Unequaled durability — polyester is impervious to moisture and all atmospheric conditions. Unlike concrete, it will not age or deteriorate under normal operating conditions.

The cleats are solidly bonded together by a special high-strength reinforced resin. This results in greater column strength and greater resistance to short circuit stresses between units—permits closer spacing between reactors, without the use of braces.

These new, smaller Westinghouse dry-type reactors are available in all ratings for indoor and outdoor service. For more complete information, call your nearby Westinghouse sales engineer, or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70753

YOU CAN BE SURE...IF IT'S Westinghouse



Stronger than the pin that supports it

SO STRONG . . . Torque test shows strength sufficient to strip threads on lead bushed pins and actually twist pole top steel pins.

This great strength saves installation time. It is not necessary to loosen Kimble tempered insulators for line-up with the conductor. Their strength will always allow another quarter-turn.

If it's on the pin, it's in service

In the event of shattering due to severe mechanical shock, insulator disintegrates into many small, non-sharp fragments. Trouble shooters can locate broken insulators—fast.

What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. Kimble insulators are more than strong enough to meet the severe tests required.

Why not see how tempered glass can cut your line maintenance costs. Write for descriptive folder that gives complete details. Address: Kimble Glass Company, subsidiary of Owens-Illinois, Dept. EW-8, Box 1035, Toledo 1, Ohio.

KIMBLE INSULATORS
AN (O) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES • TOLEDO 1, OHIO

NOW!

YOUR CHOICE OF 2 SIZES in...

BLACKBURN *Aluminum* SERVICE-WEDGE CLAMPS

W2-OA—For 2 solid or 4 ACSR to 1/0 ACSR. Standard Stainless Steel Ball
W6-4A—For 6 solid or 6 ACSR to 4 ACSR. Standard Stainless Steel Ball
Type FC—Flexible ball of phosphor bronze, both ends captured in clamp.
Type VP—Standard ball with abrasion resistant Vinyl Plastic covering at point of contact.
Type FF*—Flexible ball of phosphor bronze, one end captured—one end free.
*This type available in W6-4A only.
BLACKBURN W2-OA
BLACKBURN W6-4A

ALL BLACKBURN WEDGE CLAMPS HAVE FULL GRIPPING SURFACE

—Conductor is in contact with the wedge for the entire length of the slider and, *they are easily installed.*

- **Removable aluminum slider allows clamp to be installed without threading through clamp.**
- **Drop wire can be pre-sagged and cut to exact length—saves conductor—saves time.**
- **Clamp can be attached to bare neutral at any point in the span.**

Available through electrical wholesalers everywhere.

JASPER BLACKBURN CORPORATION

35 MADISON STREET
ST. LOUIS 6, MISSOURI
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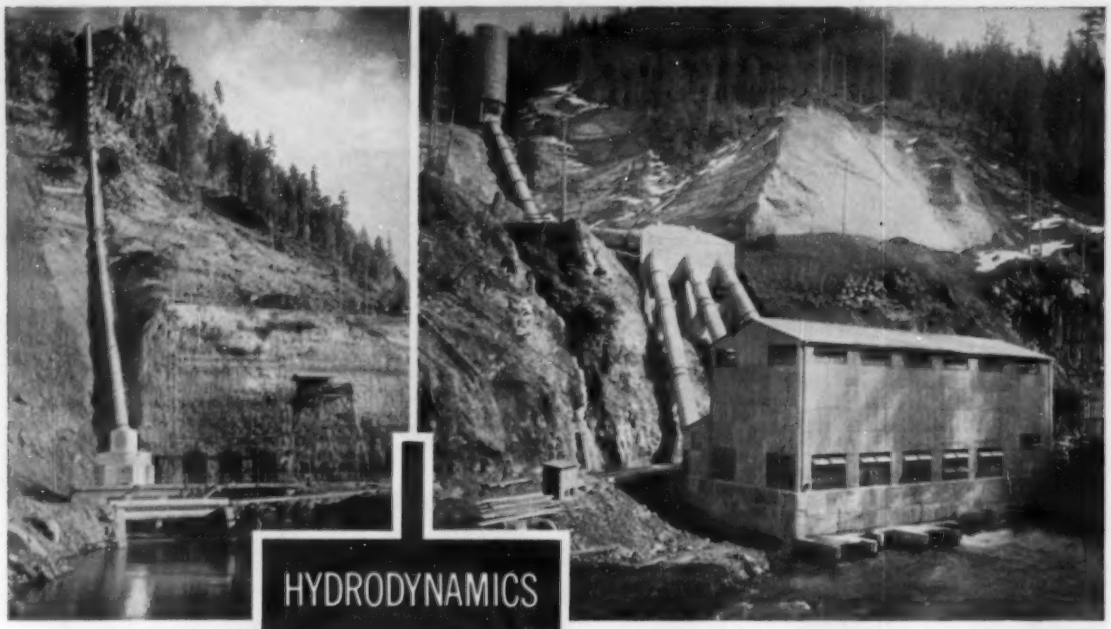


Clearwater No. 2 Station, typical of the seven outdoor stations remotely controlled from Toketee, contains one 39,350 HP SMS turbine with elbow type Pressure Regulator and Butterfly Valve. The net head is 742 ft.

Toketee is the main operating Control Station of COPCO's North Umpqua hydro project. It contains 3 SMS 20,700 HP turbines with Howell-Bunger Valve Pressure Regulators and Butterfly Valves. The net head is 433 feet. Consultants on the North Umpqua project: Pioneer Service and Engineering Company.

Planned and Accomplished: LOW-COST POWER

Eight years ago, California-Oregon Power Company was faced with two major challenges. One was its accelerating load demand for low-cost power; the other, that of the rugged, undeveloped and remote North Umpqua River territory to "come and get it." In a continuing race between construction and the load demand, both challenges have now been met. Six of the eight plants are now delivering power, and the last two are nearing completion.

Prime factors in the economies of the project are a central attended station of conventional design – Toketee – and seven unattended stations of the remote controlled, single unit, outdoor type. These factors contribute to economy in both construction and operation.

On this project are 5 SMS turbines with a total rated output of approximately 124,000 HP, 8 Howell-Bunger Valves – 3 of which are interconnected with the Toketee Turbines as Pressure Regulators – 6 Butterfly Valves, 2 Elbow Type Pressure Regulators and 2 motor operated Trash Rakes. All are in satisfactory operation, and are exceeding guaranteed performance. For full information on hydraulic turbines and accessories, contact us at York, Pennsylvania.

Hydraulic Turbines
Pumps
Gates & Hoists
Trash Rakes
Accessories

HYDRODYNAMICS

Rotovalves
Ball Valves
Butterfly Valves
Free-Discharge Valves
Controllable-Pitch Ship Propellers

S. MORGAN SMITH CO.

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

DEPENDABLE...

despite weather or structural warpage!

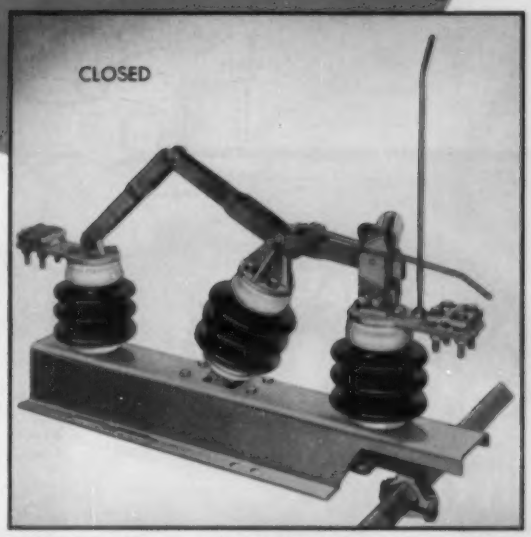
KEARNEY

Tilting Insulator Group-Operated Switches

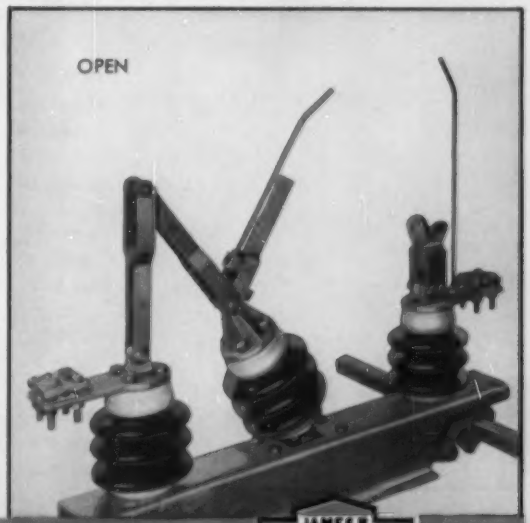
Here's a truly trouble-free disconnect! Even under extreme icing conditions, the "pry-out" blade breaks free easily. The high leverage of the Kearney "toggle" linkage lifts it from the jaws smoothly and easily . . . closes it without slam or damage to the insulators.

And it will work perfectly even if the switch poles are out of alignment. The interphase shaft clamp is designed to compensate for structural warpage. For easy installation, the interphase shaft can be lifted into the clamps after the switch is in position.

- *Oilite bearings support the tilting insulator*
- *Extra long jaws . . . blade travel adjustment need not be critical*
- *Silver-plated blade-to-jaw contacts*
- *Sturdy, deep-drawn base with wide bearing flange to prevent cutting into crossarms*



TYPE KT-3 Ratings 400 - 600 AMP. 7.5 to 34.5 KV.



275

For Better Construction . . . Safer Maintenance

Specify **KEARNEY PRODUCTS**

JAMES H. KEARNEY

The Mark of Quality

JAMES R. KEARNEY CORPORATION • 4234-42 CLAYTON AVENUE, ST. LOUIS 10, MISSOURI • Canadian Plant GUELPH, ONTARIO

Taming

COATING RESISTANCE is carefully measured with equipment shown above. Adjustments are made on coating machine with data from this test.

ALLIS-CHALMERS POWER Transformers

EPSTEIN TEST IS MADE ON steel to recheck supplier report on watt loss per pound. Epstein strips are stress-relief annealed before undergoing tests. Multiple samples are taken from coils of steel, then tested in equipment shown above.

VISUAL AND MICROMETER CHECKS throughout all operations provide additional tests for size, lamination, and surface quality. At another point (not shown), core steel is annealed in special equipment in which atmosphere is controlled with respect to dew point to produce desired surface conditions.

ALLIS-

Temperamental Steel

Suppliers Check and Allis-Chalmers Double Checks to Assure High Quality Core Steel . . . Top Performance for Transformers

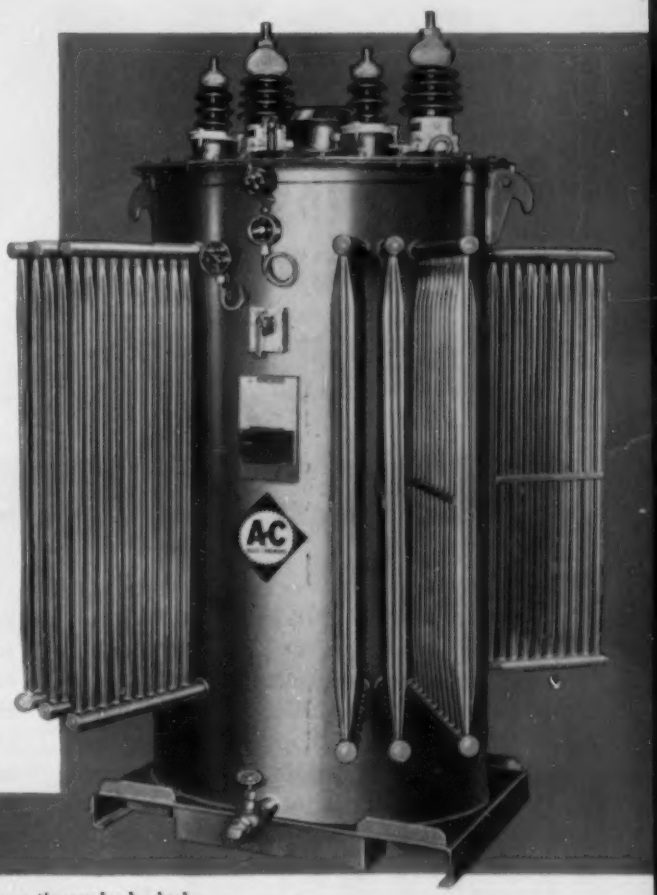
Suppliers apply tests to prove that core steel meets rigid specifications. But that's not enough for Allis-Chalmers. Here's what A-C engineers do to assure highest quality incoming raw materials.

First step extends right back into supplier plants. Allis-Chalmers engineers personally inspect supplier equipment and processes at regular intervals.

As soon as steel reaches an Allis-Chalmers transformer plant, re-checks of quality begin. They do not end until the completed transformer successfully passes all tests on the final assembly floor.

Proof of the effectiveness of these tests comes from the satisfaction of the hundreds of users of Allis-Chalmers transformers. If you would like further information on any of these rigid Allis-Chalmers tests for quality, your nearby A-C district office will get you more information. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, to arrange for a visit to Pittsburgh or Milwaukee so you can see for yourself why Allis-Chalmers offers the highest quality.

A-4706



STEEL SAMPLES are continuously checked to eliminate edge burrs that might result from cutting and slitting operations. Thus burrs cannot cut insulation coating on adjacent laminations which could permit eddy currents to build up, with resulting hot spots in core. Interlamination resistance tests after assembly provide further check.

A-C CHALMERS

A-C ALLIS-CHALMERS

West Penn Power Company selected Gulfcrest Oil to lubricate this 140,000 kilowatt unit on the basis of its outstanding performance in the other turbines at their Springdale, Pennsylvania Plant.

–they looked at the record and again selected

GULFCREST OIL

When the West Penn Power Company looked at the record of Gulfcrest Oil in its seven turbine units at Springdale, the choice of lubricant for Number Eight was no problem—Gulfcrest again!

Here's what the record showed: In each of the seven units the original fill of Gulfcrest had been in service for years without any significant changes in its characteristics. And of course the turbines operated continuously and dependably during this period.

A record like this did not just happen. It is the result of careful selection of crude oils that are thoroughly refined, then super-refined by Gulf's exclusive Alchlor Process, which removes the unstable hydrocarbons that remain after normal refining. This discarded portion, if allowed to remain in a turbine oil, accelerates oxidation, increases neutralization number, forms sludge, and harmful acids.

So to insure safe, long-lasting protection for your turbines, specify Gulfcrest—the world's finest turbine oil. Contact your nearest Gulf office today and have a Gulf Sales Engineer recommend the proper grade.

GULF

THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS

GULF OIL CORPORATION • GULF REFINING COMPANY

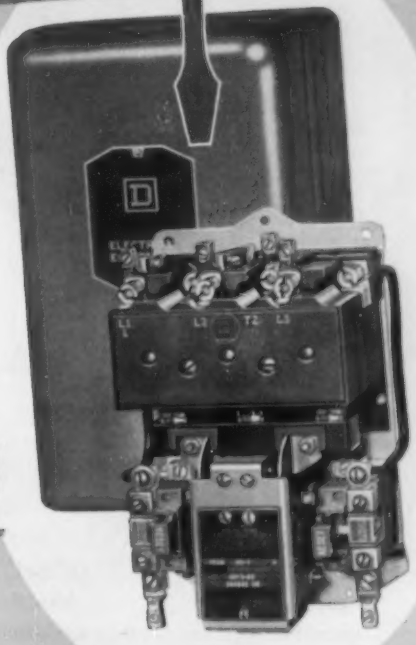
1822 GULF BUILDING, PITTSBURGH 30, PA.

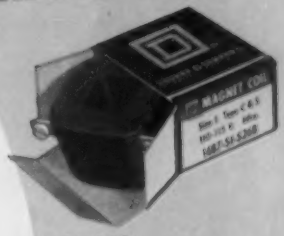
Qwik Change

with PACKAGED MOTOR STARTER PARTS!

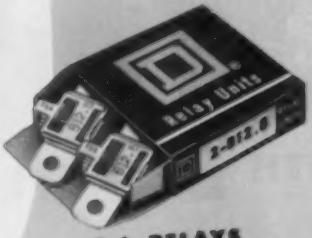
INTERLOCKS
A wide variety of quick-change, front-mounted interlocks adds flexibility for special applications

CONTACTS
Packaged replacement contacts are easily installed without disturbing wiring





COILS
Screwdriver is only tool required for quick change of magnet coil to accommodate different voltages



O. L. RELAYS
A wide variety of easily selected, packaged overload relay heater units provides quick changes to meet varying requirements for overload protection

PUSH BUTTONS AND SELECTOR SWITCH
These Kits contain all parts necessary to make quick changes from standard starters to either push button or selector switch controlled devices

EASY to Identify!
EASY to Buy!
FASTER to Install!

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

SHIELD YOUR EQUIPMENT FROM SHORT CIRCUITS OF INCREASING MAGNITUDE...

WITH EC&M (2200-5000 VOLT) MOTOR STARTERS

You don't have to be close to a source of generation to have a serious fault. Transmission lines everywhere are increasing to match industry's growth, and your vital equipment is a vulnerable target unless fully protected.

EC&M provides a wide selection of Motor Starters to guard your vital drives from costly down-time, damage and repairs. They clear a faulted circuit quickly. After the cause of the fault has been removed, you can re-start in a matter of seconds with EC&M Motor Starters.

Note the 3 interrupting capacity ratings in the following table. This applies to both Oil and Air-Break Starters. Be sure you have the facts on this wide choice of EC&M Motor Starters for 2200-5000 volt motors.

Write for new handy catalog 6062 showing complete coverage of 2200-5000 volt motors.

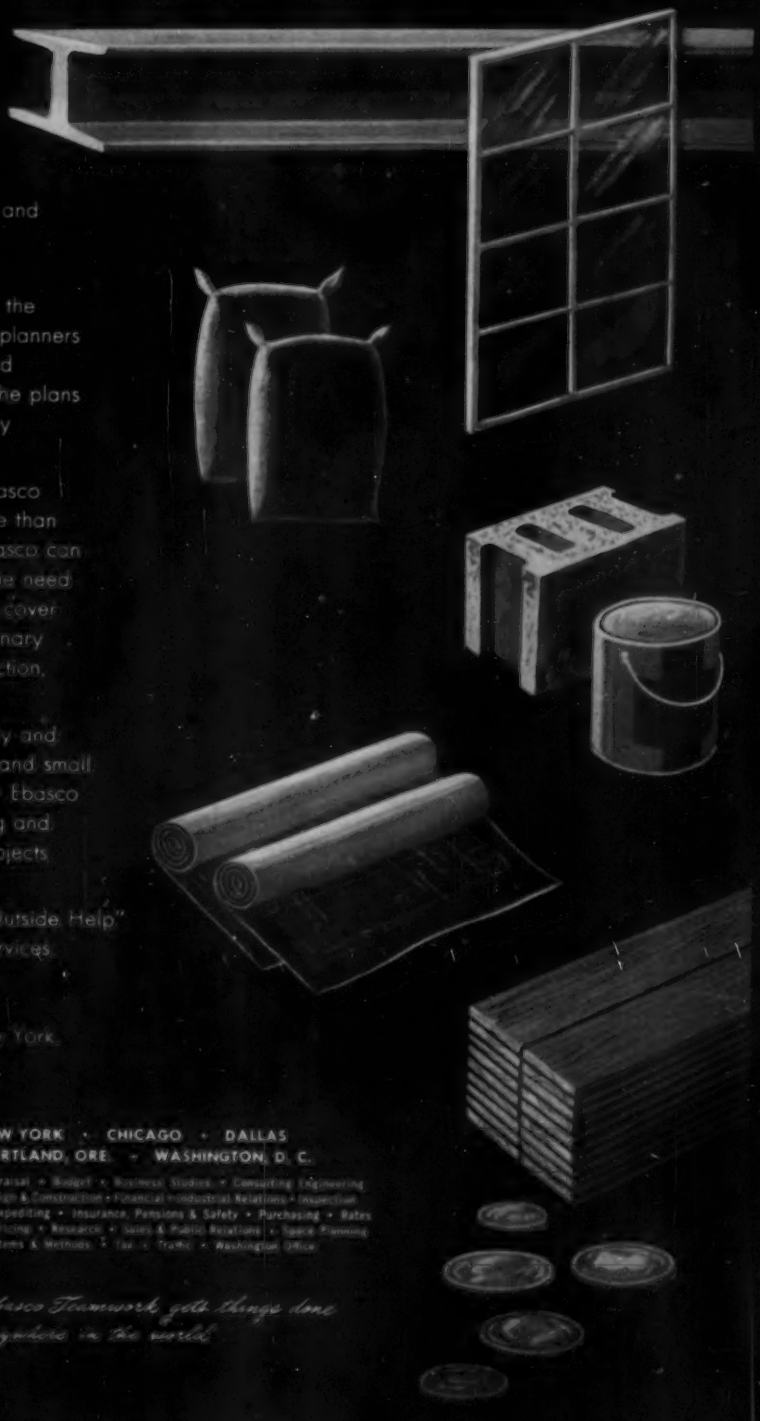
New EC&M type ZHA Air-Break Starters are CERTIFIED for 50,000 KVA interrupting capacity.

AN EASY WAY TO SELECT HIGH INTERRUPTING CAPACITY STARTERS				
50,000 KVA*	POWER FUSES		VALIMITOR	
2200-5000 volts	2300 volts	4800 volts	2300 volts	4800 volts
	150,000 kva	250,000 kva	unlimited kva bus	

*Certified

THE ELECTRIC CONTROLLER & MFG. CO.
4498 LEE ROAD • CLEVELAND 28, OHIO

what are new plants made of?



Into a new plant go steel and glass and concrete—machines and metals, manpower and money.

More important, however, is the skill, the experience and the resources of the planners and constructors. The engineering and construction firm that stands behind the plans of a new plant may well hold the key to its future success.

Over its half-century of existence Ebasco has engineered and constructed more than two billion dollars of new plants. Ebasco can be brought into action the moment the need for new facilities is recognized—can cover every step from site selection, preliminary planning, engineering, actual construction, right through initial plant operation.

Our services are available, practically and economically, in building both large and small projects. Every new plant handled by Ebasco receives the same quality engineering and construction—the mark of Ebasco projects all over the world.

Our booklet—"The Inside Story of Outside Help" tells the story of Ebasco and its services. For a copy, without obligation, write Ebasco Services Incorporated, Two Rector Street, New York 6, New York.

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EBASCO
BUSINESS CONSULTANTS

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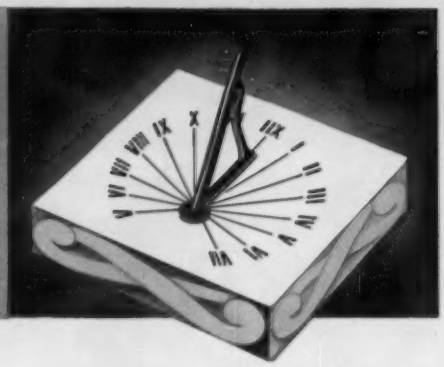
Appraisal • Budget • Business Studies • Consulting Engineering Design & Construction • Financial • Industrial Relations • Inspection & Expediting • Insurance, Pensions & Safety • Purchasing • Rates & Pricing • Research • Sales & Public Relations • Space Planning Systems & Methods • Tax • Traffic • Washington Office

Ebasco Teamwork gets things done anywhere in the world

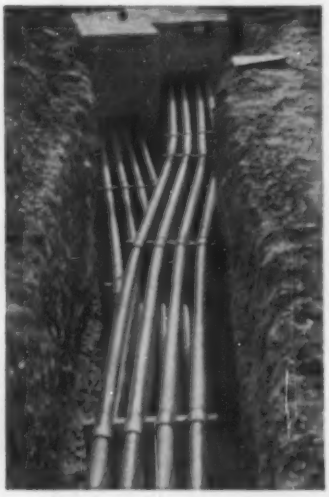
QUALITY

...proved by TIME...



Of course the most convincing proof of Orangeburg's enduring quality is its 62-year record of service to leading Public Utilities, Municipalities and Contractors.

Quality stands out in every feature. Orangeburg Fibre Conduit is lightweight yet strong, tough and resilient. Its impermeable walls and tight joints keep out corrosive ground waters. Its smooth bore and low coefficient of friction protect cable sheaths from abrasion. Orangeburg material resists acids, alkalies, salt, grease and oil.



ORANGEBURG STANDARD is installed with concrete encasement. Preferred for banks of three or more ducts.

For these and other advantages Orangeburg provides complete security for electrical services underground. Result...no interruption of power. These vital services keep flowing.

SAVES MONEY, TOO!

Saves by prolonging cable life . . . by faster and easier handling, tooling and laying . . . and by the use of Orangeburg's standard fittings. They cut costs by simplifying installation. Send to Dept. EW-85 for more facts.

ORANGEBURG MANUFACTURING CO., INC.
Orangeburg, New York
West Coast Plant — Newark, California

ORANGEBURG NOCRETE is installed without concrete encasement. Extra heavy wall for direct burial.

ORANGEBURG® FIBRE CONDUIT

STANDARD INSTALLED WITH CONCRETE

NOCRETE INSTALLED WITHOUT CONCRETE

GraybaR ELECTRIC COMPANY

DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

BRANCHES AND STOCKS IN PRINCIPAL CITIES

GENERAL ELECTRIC SUPPLY COMPANY
A DIVISION OF GENERAL ELECTRIC DISTRIBUTING CORPORATION

ALL NEW *type* MB-2

14.4 Kv AUTOMATIC CIRCUIT RECLOSER

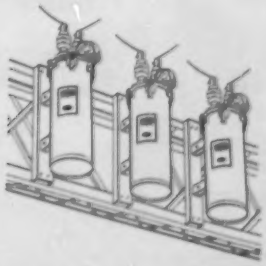
OFFERING THE LATEST IN CIRCUIT PROTECTION FROM

R&IE

The *ONLY* Power Class Recloser with these exclusive features . . .

1. **Fastest interruption** (1 cycle)
2. **Fastest restoration** (20 cycles)
3. **Highest continuous rating** (280 Amp.)
4. **Mechanical timing** (free of temp. error)

The new type MB-2 now offers the fastest circuit interruption of any relcoser. Other new important features include—optional time curves, faster inverse time, 110 Kv BIL bushing porcelain, safety lockout, large oil capacity, increased resistance to both arc wear and mechanical wear, universal tin-coated terminals, half-inch counter numerals, improved gasketing, lockout-free mechanism, and easy manual operation.



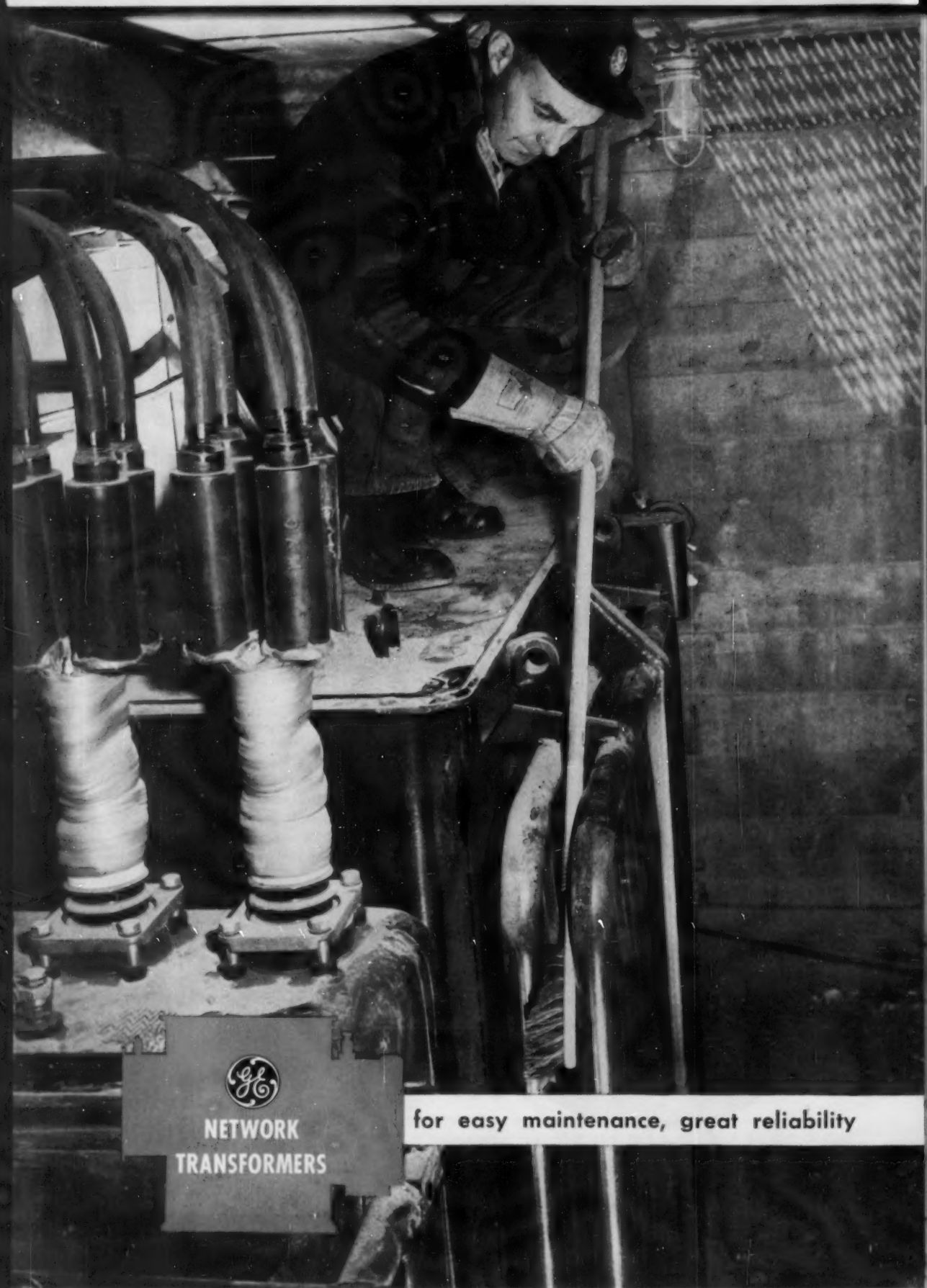
Interrupting Capacities

Continuous Current Rating—Amperes	4.8 Kv.	7.2 & 14.4 Kv
100	6000	4000
140	6000	4000
200	6000	4000
280	6000	4000

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

STRUCTURES • TESTING DEVICES • KIRK KEY INTERLOCK SYSTEMS • ISOLATED PHASE BUS STRUCTURES • INTERRUPTER SWITCHES

INDOOR BUS SUPPORTS AND AIR SWITCHES • SUBSTATION



for easy maintenance, great reliability

NEW WING RADIATORS

make G-E network transformers easy to clean and paint . . . and give extra reliability

The new "wing" radiators make it easy for you to clean and paint G-E network transformers because you have extra room to reach tubes and tank. The new radiators, featuring box-brace headers, increase reliability because they reduce the possibility of leaks and give added structural strength.

EASY TO CLEAN AND REPAINT

You can easily clean the tubes by pushing a long-handled brush between the banks of radiator tubes, either from the top or from the ends of the transformer. Periodic cleaning is the best defense against corrosive accumulations of water, sewage, dirt, and chemicals (such as salt used for snow removal).

It's also easy to repaint transformers with the new wing radiators either by the flow method or by brushing—just use a long-handled nozzle or brush in the same way you use the cleaning brush.

INCREASED RELIABILITY

By using headers to carry the circulating oil or Pyranol* from the tubes into the tank, the number of entrances to the tank is greatly reduced. On the new 500-kva network transformer, for example, there are only 16 entrances into the tank instead of 56 on the previous design. This greatly reduces the chance for leaks.

SIMPLIFIED MAINTENANCE

The tank cover and switch are welded to the tank, thereby eliminating large gasketed areas and further reducing the possibility of leaks.

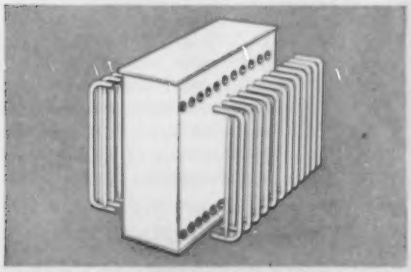
The new wing design also reduces the chance for corrosion to start. Radiating surfaces are vertical, not horizontal, and corrosive elements—water, sewage, etc.—do not readily collect on the radiators.

Maintenance is simplified in other ways. You can remove bushings, for example, from the outside of the tank. There are no large gaskets to replace. Accessories are located on the high-voltage end of the transformer where you can reach them easily. It's a simple matter to inspect the network protector because it slides out on rails.

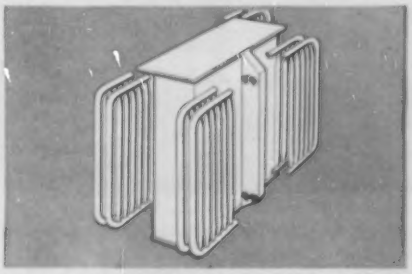
HELP FOR YOU

For help in solving your network problems and for complete information on the advantages of G-E network transformers with wing radiators, see your local G-E sales representative. General Electric Company, Schenectady 5, New York. 054

*Reg. Trade-mark of General Electric Co.



CONVENTIONAL-DESIGN RADIATORS have many tank entrances (blue circles). Horizontal surfaces collect dirt—maintenance is difficult.



NEW "WING" RADIATOR with box-brace headers has few entrances into tank and gives great structural strength, and is easy to clean.

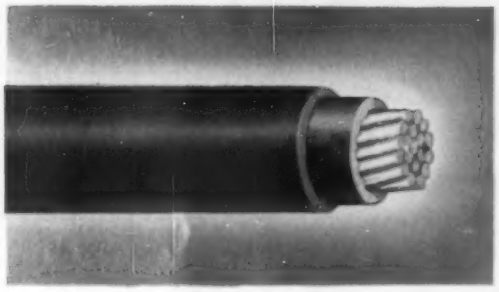
Progress Is Our Most Important Product

GENERAL ELECTRIC

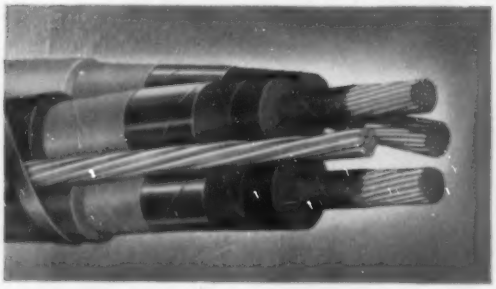
10 reasons why

you should specify, buy,

install U. S. GRIZZLY® POWER CABLES



U. S. Grizzly Power Cable, 600 volts – Type RR single conductor, Hydrosec® – S heat- and moisture-resistant insulation, Neoprene jacket.



U. S. Grizzly Power Cable, 15,000 volts – Type RR – 3-conductor, Uskorona® – ozone-resistant insulation – shielded – Neoprene jacket.

1. Lighter in weight than lead-sheathed cables and lead-sheathed armored cables.
2. Greater flexibility
3. Easier to handle during installation
4. Easier to splice, tap and terminate
5. More resistant to chemical corrosion
6. Unaffected by stray currents
7. Better protection against weathering
8. Longer life
9. Cost less
10. Made by United States Rubber Company, the *only* electrical wire and cable producer to grow its own natural rubber, make its own synthetic rubber and manufacture its own plastics

U. S. Grizzly Power Cables are used for general power distribution, and can be installed in conduits, underground ducts, buried directly in the ground, or installed aerially. Neoprene jacket protects against acids, alkalies, oils, and mechanical damage and weathering. (All IPCEA and NEMA specifications complied with.)

Write to address below for free copy of illustrated reference manual on U. S. Electrical Wires and Cables for the electric utility industry. It lists the type of cable best suited for specific requirements.

US RUBBER

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE AND CABLE DEPARTMENT, ROCKEFELLER CENTER, NEW YORK 20, N. Y.

GREEN
POWER AND PROCESS PLANT EQUIPMENT

AIRFOIL TYPE DRAFT FAN

M *ost*
E *fficient*
P *oint* of Six Designs ranges from 80-84 static efficiency

Those of you who have known GREEN for many years know that our ratings have always been conservative. You won't get less; often you get more.

With our *modernized* line of AIRFOIL Type Fans — we're calling them the GALEX Fans—we are following the same policy. Results—both test and operating—indicate our GALEX Fans will produce consistently high efficiencies. Static efficiencies are noted above. Mechanical efficiencies range from 84-88%. But with so many variables both in fan design and in operating conditions, buyers prefer the conservative ratings.

To this line of modernized, streamlined draft fans of the AIRFOIL Type, Green engineers bring more than 48 years of experience in designing and manufacturing draft fans. Actually, this AIRFOIL Type of Fan is nothing new to us. We made them in this country during the World War I era and many of those old AIRFOIL Type Fans are still in service. Today, some 35 years later, much more is known about fans and their behavior. Today, Green Fans are in an even stronger position to meet the requirements of the modern power plant.

We'll be glad to discuss your fan requirements with you and see which of the six AIRFOIL Designs would be best. With six designs, many combinations of volume and pressure are available.

GREEN THE AIRFOIL TYPE FAN Galex FAN

GREEN FUEL ECONOMIZER COMPANY, Inc.
BEACON 3, NEW YORK

200 400 600 800
200 400 600 800

FACT:

front accessibility of

Type 44 Recorder

makes servicing easier, faster

Easy to use and service—all parts fully accessible from front of recorder, a particular advantage in flush switchboard mounting.

Saves time—longer charts and greater ink capacity permit operation for longer unattended periods. Chart is more than 100 feet long, lasts up to 70 days.

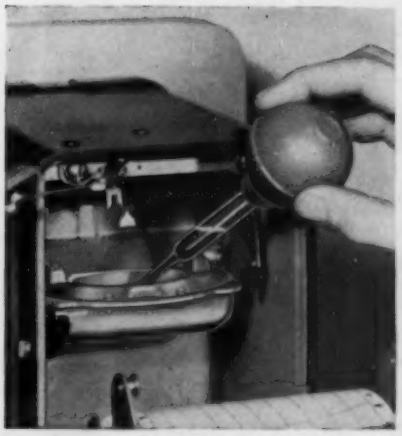
Saves switchboard space—highest ratio of scale width to panel area. Recorder is easy to read, has attractive appearance.

Westinghouse Type 44 Recorders are available in flush or projection-mounted cases, or portable models, for accurate, low-cost measuring of watts, vars, a-c voltage and current, d-c voltage and current, frequency and power factor.

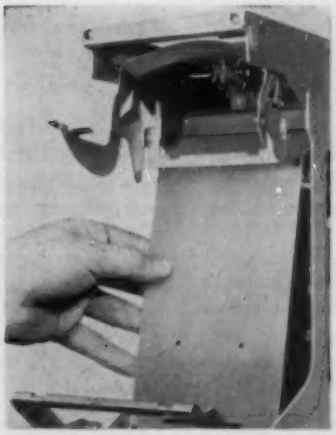
FOR MORE FACTS: Call *The Man With The Facts* ... your Westinghouse sales engineer. Or, get your copy of the facts booklet, B-5779, by writing directly to Westinghouse Electric Corp., 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa. J-40480

YOU CAN BE **SURE**... IF IT'S

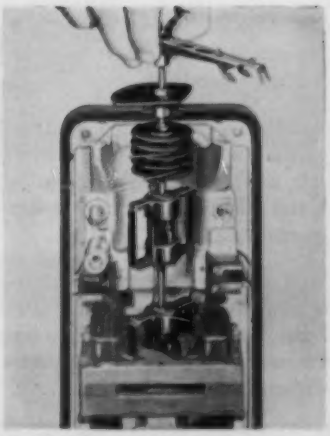
Westinghouse



Inkwell swings forward for filling without disturbing the pen... scale automatically moves out of the way. Both inkwell and pen easily removed for occasional cleaning. Chart can be replaced quickly.



Removable shield protects the measuring element against spilled ink, dirt and damage . . . assures recorder dependability. This feature is particularly important in portable recorders. Shield may be removed readily with recorder in service.



Moving elements can be removed as a unit, without disturbing stationary elements, or field circuit. One-piece electromagnets assure correct scale distribution without adjustments, and permanent calibration.

Testing Noise Levels

SORGEL transformers are known and chosen for their quiet operation, because their noise level is well below the established standards.

Because of their quiet operation, SORGEL transformers are particularly adaptable for indoor installations—in hospitals, schools, institutions, libraries, office buildings, stores, and other structures where low noise levels are an important factor.

Our new testing laboratory, with modern, complete testing equipment and facilities, enables us to know what the efficiency, noise level, temperature rise, and performance of SORGEL transformers are before the installation is made.

The liberal design of SORGEL transformers also results in high efficiency, long life, and a liberal overload capacity for emergencies.

SORGEL transformers are available in a large variety of sizes and types for every purpose. ¼ Kva to 2500 Kva single phase. 1 Kva to 3000 Kva 3-phase. All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, and up to 15,000 volts, and any intermediate or special lower voltages.

SORGEL dry-type or Askarel-cooled transformers are also incorporated in substations. Available with any type or make of switchgear, or from any substation manufacturer.

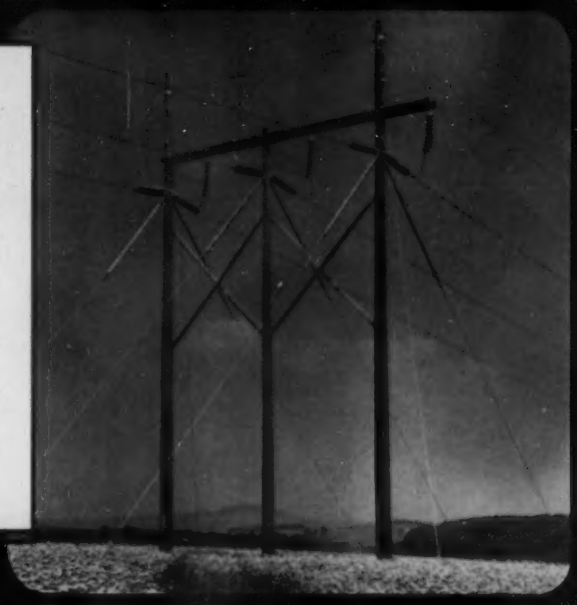
Sales Engineers In Principal Cities

SORGEL ELECTRIC CO., 834 West National Ave., Milwaukee 4, Wisconsin

40 years' experience in the development, manufacturing and application of transformers.

Potomac Edison preserves poles, crossarms with low-cost Penta because "it's cleaner!"

"The main reason we use Penta is because it is much cleaner than other preservatives," says M. J. Urner, Transmission and Distribution Engineer of the Potomac Edison Co. Since 1944, his firm has specified long-lasting Penta treatment for thousands of western red cedar poles and Douglas fir crossarms—excellent insurance against frequent, costly replacement of installations in the company's rugged Allegheny Mountain lines. Penta won't bleed or leach out of wood like other preservatives. Penta-treated wood is clean, won't "burn" hands or stain clothing.



ANALYSIS OF BORING SHOWS PENTA HITS DEEP. Chemical analysis of wood bored from Penta-treated pole shows how much Penta is present—and how deep it goes. Because Penta is a uniform chemical compound, you can actually measure the amount of preservative in wood. Penta goes deep, stays locked in wood cells, protects installations from decay and insects as well after 20 years as it does after one day!

Specify Penta for **POLES, CROSSARMS, TRANSFORMER PLATFORMS, BRACES, CONTROL BOXES, PLANKING.** *More than 85 treating plants will apply Penta for you. Mail coupon at right for this list, and for FREE "Poles and Crossarms" booklet.*

MONSANTO
CHEMICALS—PLASTICS
SERVING INDUSTRY... WHICH SERVES MANKIND

Organic Chemicals Division
MONSANTO CHEMICAL COMPANY
Box 478-C-8, St. Louis 1, Mo.

Please send: ☐ List of 85 treating plants
☐ FREE "Poles and Crossarms" booklet

Name .....
Address .....
City ..... *State* .....

which ELKONITE® *material*

fits your CONTACT *requirements?*

EVERY heavy duty electrical contact application poses its own problems. Electrical conductivity, contact resistance to arc erosion, sticking and welding, high mechanical strength, wear resistance . . . all of these qualities may be demanded in dozens of different combinations, and in many varying degrees.

To satisfy these diversified needs, Mallory has developed a complete series of Elkonite materials. By means of specialized Mallory metallurgical techniques, these materials combine metals which do not alloy by conventional means. They afford a combination of the electrical properties of copper or silver, with the refractory qualities of tungsten, molybdenum or their carbides.

From among the many Elkonites, you can choose a contact material that meets the electrical and physical specifications of your design. Often, combinations of dissimilar Elkonites (or the use of Elkonite with such materials as copper, silver or tungsten) give the best possible performance. Mallory Elkonites are *versatile* contact materials.

Call on Mallory for competent engineering assistance on your contact design problems. Call on our manufacturing facilities, too, to fabricate complete contact assemblies to your specifications. For technical data or a consultation on your application, write or call Mallory today.

In addition to the family of Elkonite materials for contacts, Mallory makes many other "families" of contact materials including silver, tungsten, molybdenum, platinum Elkonium®, palladium Elkonium, copper and copper alloys.

Expect more . . . Get more from

Serving Industry with These Products:

Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical — Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

235 Ton Powerhouse Gantry Crane
for Pacific Power & Light Co.
Engineers: Ebasco Services, Inc.

This gantry crane, with its modern, clean architectural lines, is the largest, all-welded box girder crane of its type in the United States. Electric conduits are concealed, yet readily accessible.

Its welded, rigid-frame construction reduces weight and lowers initial cost. Many features lower maintenance costs.

In addition to gantry cranes, Paceco designs and builds cranes of all types, hoists, high-pressure gates and valves, intake gates—all tailored to most economically serve your exact needs. Such equipment has been delivered at competitive prices, nation-wide and internationally. *Your inquiry is requested for preliminary discussion or invitation to bid.*

PACIFIC COAST ENGINEERING COMPANY

ENGINEERS • MACHINISTS • FABRICATORS

Alameda, California, Lakehurst 2-6100
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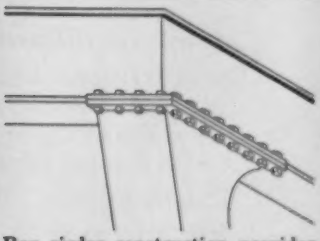
51 E. 42nd St., New York 17

PACECO
"TAILORS OF STEEL" ®

IMPORTANT FEATURES

This 235 ton crane employs a single trolley, resulting in 30% to 40% lower first cost. Note the all-welded, rigid frame. It is lighter in weight, hence lower in cost. It assures lasting, accurate alignment of hoisting machinery. Trolley is machined as a single complete unit, assuring minimum maintenance costs; continued operating satisfaction.



Box girder construction provides extra rigidity at lower cost. The rigid frame construction is designed to transmit moments from girder to legs. Fitted bolts in reamed holes are shop aligned, eliminating field alignment and providing lower cost erection in less time

FREE BROCHURE

Send for Paceco's illustrated brochure, "Custom Designed Equipment for Hydro-Electric and Steam Power Plants and Water Works"

Here's

Record-Setting Kanawha River Plant Uses Allis-Chalmers Condensers

'54 tops record-setting '53!

The 9170 Btu per kilowatthour annual heat rate at Kanawha River Plant was lowest in the nation in 1953 according to the Federal Power Commission. In 1954 the rate was even lower . . . 9133 Btu per kilowatthour, again lowest in the nation.

That means only 7/10 of a pound of coal is required to produce a kilowatthour of electric energy at this outstanding plant.

The Kanawha River Plant is owned by Appalachian Electric Power Company. It is one of 12 major power plants in the American Gas and Electric System.

Condensers are Multi-Steam Path Design

Two 90,000 square foot single-pass Allis-Chalmers condensers serve its 215,000-kw steam turbine generators.

These condensers are of multi-steam path design. This unique design makes all tubes completely effective by directing steam to even the remote sections of the condenser. The result is high vacuum, high condensate temperature and good deaeration . . . high operating efficiency.

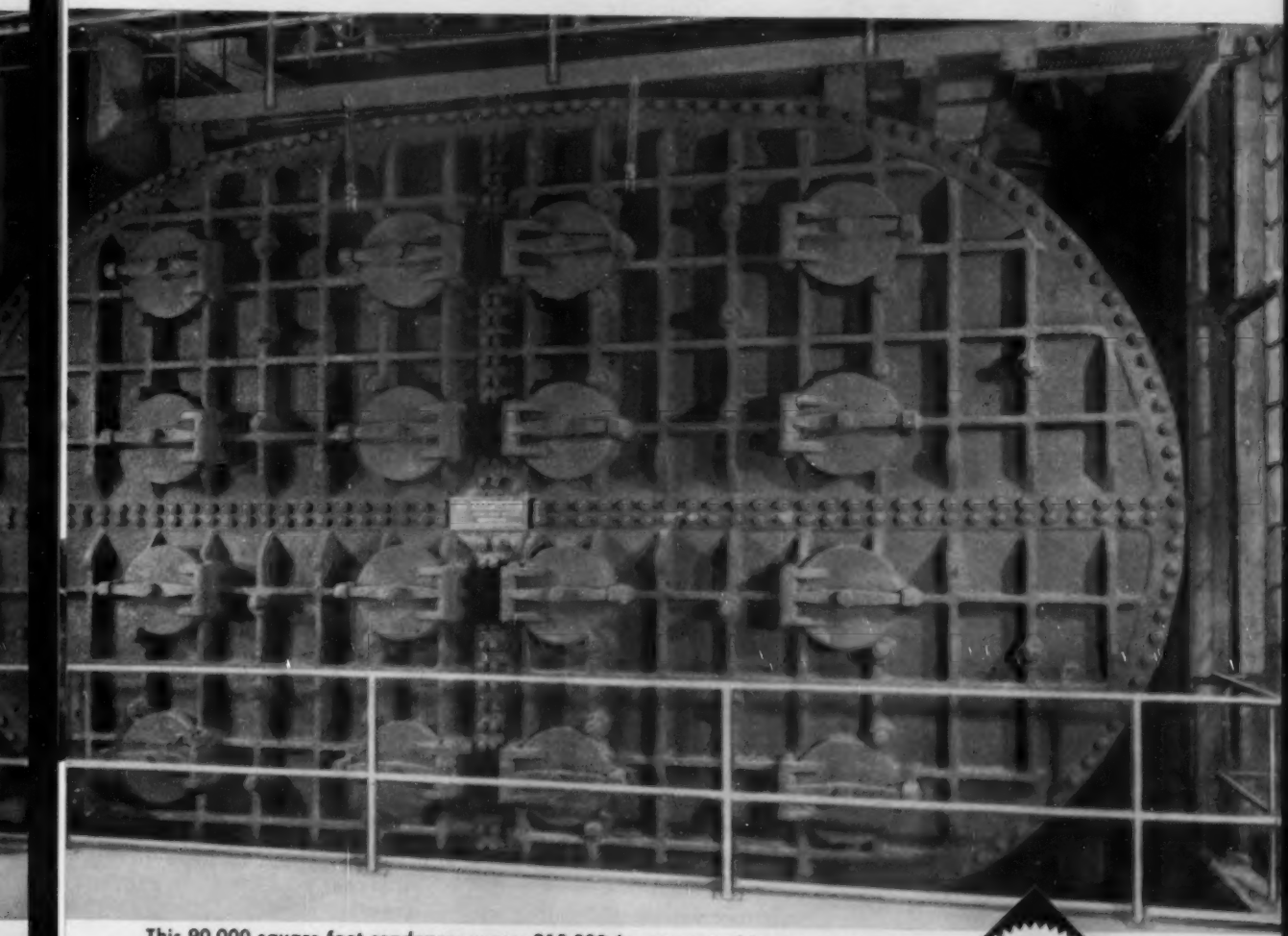
For more information on how Allis-Chalmers multi-steam path design contributes to efficiency, contact your nearby A-C office or Allis-Chalmers, Milwaukee 1, Wisconsin. A-4772

A Size and Type for Any Need

Round Oval Rectangular

ALLIS-

Condenser for Most Efficient Plant

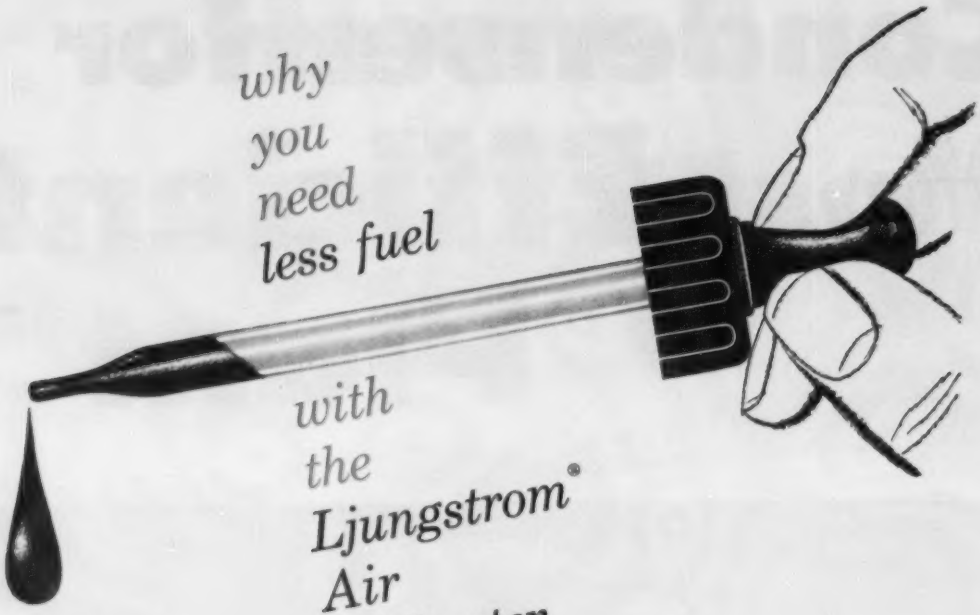


This 90,000 square foot condenser serves 215,000-kw steam turbine generator.

CHALMERS

A-C ALLIS-CHALMERS

why you need less fuel with the Ljungstrom® Air Preheater

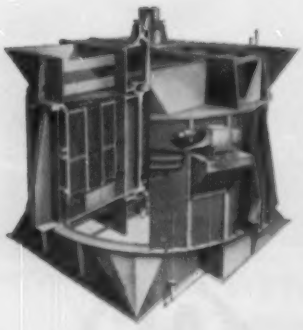


With every 45-50 F of air preheat — you cut your fuel bill 1%. That's why it pays to equip your boilers with Ljungstrom Air Preheaters. For the Ljungstrom is the most efficient air preheater there is.

Advantages of the Ljungstrom Air Preheater

- **Size for size, recovers more heat than any other type.**
- **Reduces fuel consumption. Permits use of lower-grade fuels. Increases boiler output and reliability.**
- **Eliminates cold spots . . . keeps corrosion to a minimum.**
- **Easier, faster to clean and maintain.**
- **Requires far less supporting steel and is quickly erected.**

The Ljungstrom also gives industrial plants broad latitude in their choice of fuels. Its unmatched preheating efficiency makes practical and effective such low-grade fuels as saw and paper mill refuse, wood, lignites, peat and bagasse.



Outright fuel economy is reason enough why 7 out of 10 modern preheater installations are Ljungstrom, and why Ljungstrom percentage of installed boiler capacity increases every day. Yet it's just one of the many advantages of the Ljungstrom. Get all the details on why the Ljungstrom cuts fuel costs . . . why it's the most efficient heating surface on the modern boiler . . . why it's easier to clean and maintain. All the details are in the new, 38-page reference manual, "Ljungstrom Air Preheaters." Write for it, today.

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Bulletin No. H307-255

PROVED BEST . . .

ALL ALONG THE LINE

Moloney HiperCore Transformers are fabricated with skill and care all along the line of production. Thus each and every HiperCore Transformer will offer dependability, efficiency and long life in operation all along the utility system.

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SALES OFFICES IN ALL PRINCIPAL CITIES

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PROVED BEST . . .
FEATURE BY FEATURE . . . . . .

Hi-strength, wet-process, keyed porcelain HV Bushings.

Positive Seal Tank Covers.

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Moloney HiperCore Transformers are available from stock in all Standard Ratings in both Conventional and CSP designs.

Rust-resistant, copperbearing steel tanks, resistance welded with triple thick roll base.

High pressure, positive snap action tap changer and HV Terminal Block.

MOLONEY ELECTRIC

Feature by feature Moloney HiperCore Transformers offer the best reasons why your system should incorporate dependability and efficiency in distribution. Each HiperCore Transformer offers features which your system needs to operate as planned. Over 60 years of research, engineering and design exclusively devoted to the manufacture of transformers is your guarantee that "When you buy Moloney . . . you buy the best".

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SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO., AND TORONTO, ONT., CANADA

EDITORIALS

Tell the Public More About Federal Power

Year	1943	'45	'47	'49	'51	'53	'55
Proportion of voting public who have heard of TVA—%	74	65	69	66	66	63	68
Of those who have heard, these approve of TVA—%	61	63	67	63	58	55	47

It was said of a political figure, "You have to know him well in order to really dislike him." Just how much truth was in that surmise, we don't venture to say. But the results of the most recent public opinion survey of the Electric Companies Advertising Program does indicate there is some validity in this thought as applied to Tennessee Valley Authority.

In a general way the survey results show that the more people who are familiar with TVA, the fewer tend to approve of the agency (see table above). It must be said that this is a recent development and departs somewhat from previous experience. Under the circumstances though, we believe it indicates the beginning of a trend.

The former Dixon-Yates contract and the controversy surrounding it revived public interest in TVA during the past two years. Public-minded people were given a chance to review the background and the operations of the agency. Although the great bulk of the news stories on the Dixon-Yates contract originated from pro-TVA sources, these apparently did not obscure the facts relative to the federal power aspects of the agency. In the thick of the battle (the survey was conducted in mid-January) a number of adherents were withdrawing their support as the above figures show.

Survey results back over the years show that the agency was much in the public attention back in 1943 but gradually lost ground except for 1947 when the New Johnsonville steam plant controversy was in the news. Following that, the proportion of people who had heard of TVA again dwindled until the survey this year.

Trend of TVA adherents followed pretty much the same pattern until the recent survey. When TVA was in the scrap for its first large new steam plant at New Johnsonville, it managed to actually pick up public support—note the 1947 gain. But in the Dixon-Yates controversy, the proportion of people approving the agency took a sudden dip.

There appears to be a lesson here that should be exploited by electric companies: Help the public learn more about the workings of federal power. The better they understand it, the less they like it.

$100 Reward Offered

Washington Water Power Co provides the electric companies with an imaginative example of how to handle misstatements of fact hurled against them by public power advocates. The example: an immediate, well-documented rebuttal in a form which will draw public attention.

When a local public utility district commissioner claimed in a public statement that PUD's pay as much taxes as electric companies, Washington Water Power did not pass over the comment as another bit of sniping by public power supporters. Instead, it set out at once to show up the commissioner's statement for what it was.

In paid advertisements in several local papers, Washington Water Power offered a $100 reward for any person who could prove the truth of the commissioner's claim. As an afterthought, the company also offered to furnish pamphlets and statements relative to the claim.

The result was immediate and gratifying to the company. Hundreds of people wrote in for the literature. It was apparent that the company had many friends.

Too many misstatements and fallacious arguments like the commissioner's have been allowed to go unchallenged by electric companies. It is a part of the duty of the electric company executives to keep the public fully and accurately informed about the public services they render. Too often rebuttals and replies have come too late to be effective. Little thought has been given to attracting the public attention that company statements deserve.

There is now general recognition in the industry that this situation exists and must be corrected. Washington Water Power in this instance points the way.

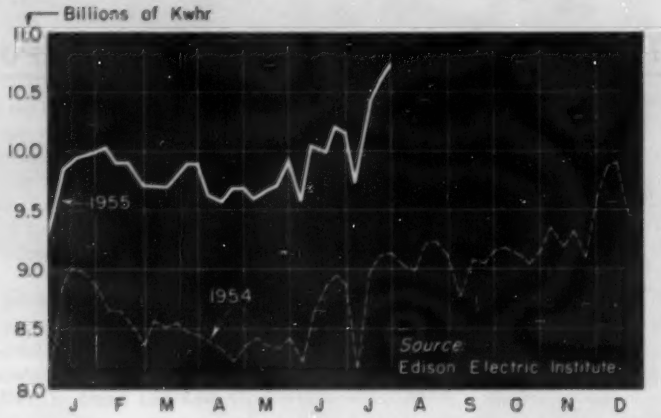
And, incidentally, nobody has yet put in a claim for the $100 reward.

"Skimpy" Joins Battle

"Skimpy Wiring", Kennecott Copper Corp's cartoon symbol for inadequate wiring, can become a major aid in helping to erradicate one of the electrical industry's most worrisome problems. Advertising men for years have been trying to find concrete ways of symbolizing inadequate wiring. Electrical World had a go at it in a series of institutional ads using a black cat and the multiple, three-way socket arrangement as well as other devices.

Most electric utilities have attacked the problem of illustrating inadequate wiring in one way or another.

These have helped, but more impact is needed to point up the problems of inadequate wiring. It is just possible that "Skimpy Wiring—the Dead End Kid of the Electrical business" is the symbol that is needed.



OUTPUT
Week Ended July 30
10,727,000,000 Kwhr
UP 17.4%

Atomic Energy Commission requirements — 913,000,000 kwhr (Electrical World estimate). Excluding AEC, output increase was 12.0%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
July 30	+17.4	+12.0	+13.3	+31.8	+14.4	+24.0	+2.9	+2.4	+12.4	+5.2
July 23	+16.7	+12.5	+17.1	+30.8	+6.3	+22.0	−3.6	+13.4	+11.1	+7.6
July 16	+16.6	+10.8	+14.1	+29.3	+6.8	+22.4	+4.6	+11.7	+12.0	+5.8

Seasonally Adjusted Index 202.6 Week Ago 201.5 Year Ago 173.4

The Issue's Highlights: Coincident with opening in Geneva of U. N.'s atoms-for-peace conference there were these atomic developments here: Pennsylvania P&L announced it would build, with private funds, a 150,000-kw nuclear power plant in cooperation with Westinghouse; details of first co-op nuclear power plant were disclosed by Elk River (Minn.,) Rural Co-operative Power Association; Canada announced construction and financial details of its first nuclear power plant; a McGraw-Hill survey shows Britain's progress in commercializing its atomic developments . . . First break comes in copper strike stalemate with Phelps Dodge settlement . . . GE is testing 138-kv, 10,000 Mva air-blast circuit breaker . . . PS of Oklahoma solves its voltage problems caused by air conditioning load by installing both switched capacitors and reactors on its lines . . . Yearly power bill equal to month's salary for one farm hand can cut dairy costs by yearly salary of the farm hand.

Field tests of ultra-high voltage lines at high altitudes in Rocky Mountains will be made next spring by Public Service of Colorado in cooperation with six manufacturers. Slated for construction this fall at 10,300-ft altitude is ultra-high voltage substation and about 1 mile of 3-phase, 330-kv line using single and bundled conductors.

There will be no action this year on proposals to give TVA permission to issue revenue bonds to finance future expansion. Senate Public Works subcommittee considering bill has postponed hearings until January. House subcommittee has twice postponed matter. Before postponement, National Society of Professional Engineers let it be known that financing measure did not please them. Bill would permit TVA to provide engineering services to non-TVA groups—"an unwarranted interference with normal functions and operations of private consulting engineers . . ." said the society of engineers.

Rates and Regulatory: Duke Power has received Utilities Commission approval to buy Carolina Aluminum's electric distribution and street lighting systems at Badin and High Rock for $17,656 . . . South Carolina PSC has approved about 20% rate reduction by South Carolina E&G for primary and high schools in Columbia and Charleston . . . West Virginia has hiked utility property valuations for tax purposes about $28.5 million over year ago. Taxes by utilities, which last year totaled over $15 million, are expected to reach new high this year . . . Arizona Power Authority has cut wholesale power costs 0.5 mill per kwhr to municipalities and private purchasers. Cut means $330,000 a year revenue reduction to APA and includes $94,602 a year reduction to Arizona PS.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Washington's Gov Arthur B. Langlie has announced his opposiiton to Tacoma's proposed $137-million Cowlitz River hydro project. Project would damage salmon runs and produce "negligible, if any," gain in low cost power, he said . . . Refinements in power house of Ice Harbor Dam on Lower Snake River will produce 270,000 kw initially, according to Herbert G. West, executive president of Inland Empire Waterways Association. Provisions have been made for possible ultimate capacity of 540,000 kw he said.

Finance: Atlantic City Electric is planning to split its common stock on 3-for-2 basis . . . Washington G&E and Seattle Gas stockholders have approved merger. New company will be known as Washington Natural Gas Co . . . Hawaiian PUC is encouraging a merger between Hilo Electric Light Co and Kona L&P.

It's not the heat, it's the cupidity: In Mexico, eight men were arrested on charge of stealing 10 miles of power cable valued at $84,000. They climbed towers leading to new project and cut down an unused line.

Gordon R. Clapp, former TVA chairman, has resigned as deputy New York City administrator. He will join David E. Lilienthal, whom he succeeded in the TVA post, in Lilienthal's private management consulting work . . . Senate has approved nomination of Harold C. Patterson as Democratic member of SEC . . . West Texas Utilities has elected Calvin Young president, succeeding Price Young who becomes chairman.

Dixon-Yates: General Accounting Office ruled last week that government had concluded "effective contract" with Dixon-Yates group and, therefore, was liable for cancellation damages. But Assistant Comptroller General Frank H. Weitzel, who wrote opinion, added GAO believes means to protect interests of government should be considered if it "develops that the government is entitled to release from liability on grounds of public policy." There were these other developments: Sens Estes Kefauver (D-Tenn.) and William B. Langer (R-N. Dak.), comprising two-thirds of Senate anti-monopoly subcommittee, referred to Justice Department for possible perjury action what they called "glaring conflicts" in testimony of Edgar H. Dixon, president, Middle South Utilities, Inc; Joint Atomic Energy Committee agreed not to act on bill which would have assured funds to pay cancellation costs to Dixon-Yates.

ABOUT PEOPLE IN THE INDUSTRY

As Congress prepared to adjourn, Sen Clinton P. Anderson (D-N. Mex.), chairman of joint atomic energy committee, took steps to keep Dixon-Yates issue alive. He informed the White House, AEC, Budget Bureau, and Justice Department, that his committee wanted monthly reports on all developments relating to cancellation. "Only way I know to save forgetful or careless government officials from themselves is to request all agencies involved in cancellation talks to make monthly written reports," said Anderson.

Pacific G&E will distribute Trinity River Project power to its 1.6 million electric customers without discrimination, according to Robert H. Gerdes, executive vice president. Project, in which PG&E will handle power aspects and government the other features, has passed Congress and gone to President for signature. "Company can make no profit on falling water it purchases. All that is allowed is a fair return on its own investment in facilities used and useful in service to public," Gerdes said.

More News About People page 186

Opening of UN Atoms for Peace Conference marked by . . .

Atomic Development at Home, Abroad

A series of late developments in the field of nuclear power marked the approach of the United Nation's International Conference on Peaceful Uses of Atomic Energy, scheduled to begin this week in Geneva, Switzerland.

The Elk River (Minn.) Rural Cooperative Association disclosed reactor plans for its nuclear power plant, the first proposed by a Rural Electrification Association co-op (see story on p 61). And from Canada came a detailed account of that nation's plans for its first atomic power plant (see p 62). Pennsylvania Power & Light Co added to the excitement with announcement of its decision to build a privately financed reactor and power plant with Westinghouse Electric Corp as co-developer (see p 64).

With atomic plans mushrooming in North America, manufacturers in Britain, spurred on by their nation's Atomic Energy Authority, prepared to descend on Geneva with open order books, proclaiming that the atom had moved from the laboratory on to the sales counter (see page 64).

In Geneva, Lewis L. Strauss, chairman of the U. S. Atomic Energy Commission, declared that "great things" were expected of the conference. Strauss had arrived early on the scene to make advance preparations as head of the 300-man U. S. delegation.

A considerable portion of the U. S. atom show at Geneva comes from the Argonne National Laboratory presenting 51 technical papers, 24 orally; ten exhibits; scale models of four Argonne-designed reactors; and two motion pictures.

One of the movies records what happened in 200 safety experiments in which a reactor was made to "run away." Included will be shots of a test which destroyed a reactor by permitting its power to rise to more than 10-million kw in less than a second. The filmed tests were reported to have contributed greatly to the development of reactors for production of electrical power.

Dr Walter H. Zinn, director of the Argonne Laboratory and 24 scientists on his staff, will attend the conference.

Some indication of the contribution to be made by other nations attending the conference was contained in a 32-nation survey recently released by Atomic Industrial Forum, Inc (see table).

Survey of World's Reactors

Of the 42 reactors known to exist in the world, the Forum reported that 29 are located in the U. S., five in Great Britain, two in France, two in Canada, one in Norway, one in the Soviet Union, and one in Sweden. Another has been set up for display in Geneva and will be sold to the Swiss government after the show.

Twenty reactors are known to be under construction including nine in the U. S., three in Britain, and three in France. Britain leads in the number planned for construction with 22. The U. S. is second with 16.

In commenting on its survey, the Forum stated, "It is generally assumed that additional reactors are in existence and under construction in the Soviet, but the Soviet government has not announced them (and) . . . the Soviet Union failed to respond to the Forum survey."

As the U. S. prepared to show off its past achievements, the AEC came up with some good news for future development.

AEC's Report

In its semi-annual report to Congress, the AEC stated that domestic uranium production had climbed to "record levels" in the first half of 1955. The report praised the "greatly accelerated exploration activity" by private industry which discovered "potentially large deposits of uranium ore in presently non-producing areas off the Colorado Plateau."

Ore production, the report said, continued to exceed capacity of processing mills; as a result, ore stockpiles had been created at existing mills and at locations designated for new mills.

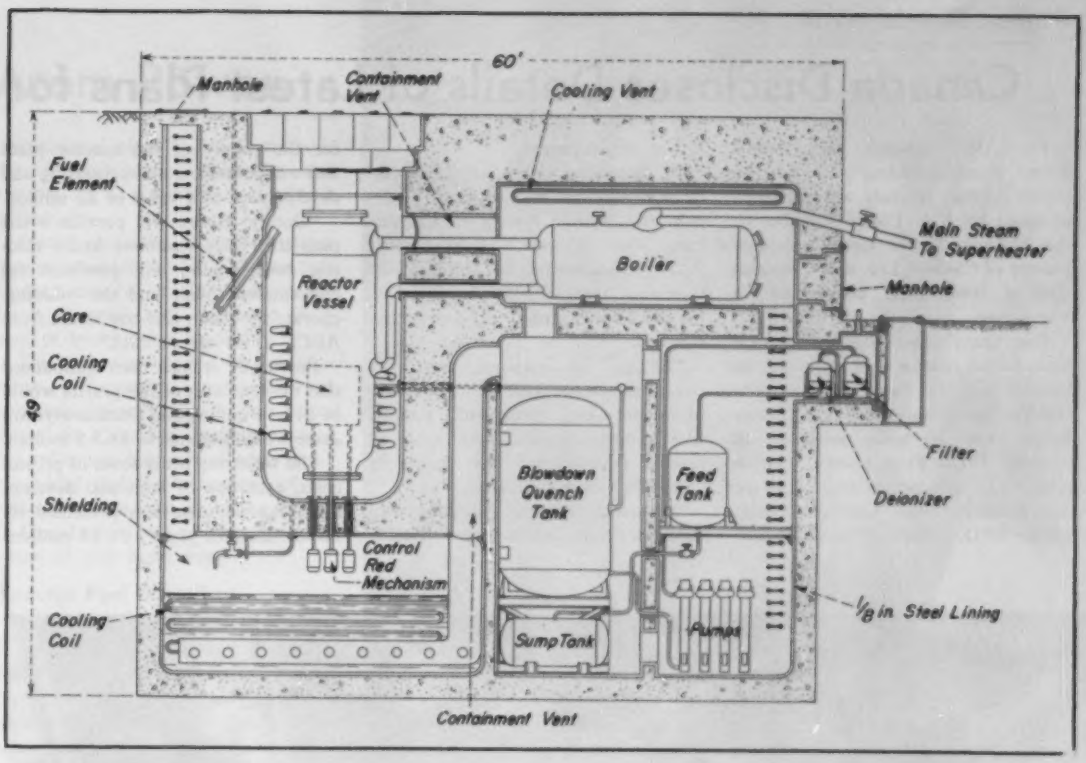
The AEC listed about 850 uranium mines which were producing in June as compared to 795 a year ago. In addition, the report stated that 17 ore-buying stations had been created to speed flow from mine to mill.

World Survey of Atomic Progress

(Conducted by Atomic Industrial Forum, Inc.)

Nation	Nuclear Reactors		
	Existing	Under Construction	Planned
United States	29	9	16
Great Britain	5	3	22
France	2	3	3
Canada	2	1	1
Norway	1	..	..
Soviet Union	1*	1*	..*
Sweden	1	..	1
Switzerland	1	..	1
Australia	..	1	..
Belgium	..	1	1
India	..	1	..
Italy	..	..	1
The Netherlands	..	..	1
West Germany	..	..	1
Total	42	20	48

*The Soviet Union did not reply to requests for information. Consequently, statistics for the survey were obtained from public announcements made by the government.



Atomic Development

First Nuclear Plant for REA Co-op Proposed

The first nuclear power plant for a Rural Electrification Administration co-operative has been proposed by the Rural Cooperative Power Association of Elk River, Minn. The co-operative desires to build a 22-Mw nuclear power unit at its existing steam plant site near Elk River provided the Atomic Energy Commission and the REA approve plans and financing.

The reactor would be a boiling water heterogeneous type and would be supplied by American Machine & Foundry Co. A separately fired superheater would be used to obtain better steam conditions, and the heat exchanger would be used to prevent radioactive fluids from flowing in the turbine or boiler-feed water circuit.

Total cost of the plant, excluding fuel, has been estimated at $4.9 million. Total production cost of 80% load factor would be 6.29 mills per kwhr. If the plans are approved, it would require 3½ years to build.

The co-op now operates a conventional power plant at Elk River, 30 miles north of Minneapolis.

The application, which was submitted June 14, proposes that:

1. Engineering design and development costs, and equipment and construction costs of the nuclear steam generator would be paid by AEC and then repaid by the co-op on standard REA terms. Estimated costs: $3 million.

2. Nuclear fuel would be loaned without cost by the AEC. Estimated value of fuel load: $1.4 million.

3. Cost of nuclear fuel burn-up, fabrication, and processing would be paid by the co-op. Estimated yearly charge: $283,000.

4. Conventional turbo-generator portion of plant would be paid for by the co-op through a loan from the REA. Estimated cost: $1.9 million.

5. All maintenance and operating costs would be paid by the co-op which would also contribute land for the plant site.

The boiler part of the plant consists of a boiling heterogeneous reactor, primary heat exchanger, separately fired superheater, and auxiliary equipment which will supply 222,000 lbs of steam per hr at 650 psig and 825F. Temperature of the water in the reactor is 533F. An allowance has been made for a 50 psi pressure drop in the main steam line and the superheater.

The proposed reactor is rated at 58 Mw of heat and uses zirconium alloy-clad natural uranium fuel elements. Power density is 20-30 kw per liter. If a superheater were not used, a reactor of 84 Mw heat capacity would be required for the same net output.

Steam produced in the reactor flows to the tube side of the heat-transfer surface in the primary heat exchanger. There it condenses and flows by gravity to the reactor vessel.

Constant steam pressure in the secondary system is maintained at all loads by varying the water level in the shell side of the primary heat exchanger. Highly demineralized water will be used in both the primary and secondary loops. Reactor steam pressure is controlled independently of the secondary loop. Control rods respond to reactor pressure changes.

Canada Discloses Details of Latest Plans for

Plans for Canada's first atomic power plant, including that nation's fourth reactor, recently were revealed in detail by J. S. Foster, member of the Nuclear Power Group, Atomic Energy of Canada, Ltd, at a Canadian Electric Association convention in Vancouver.

The heavy-water moderator, uranium-fueled reactor and plant will be located near the Des Joachims 380,000-kw hydro station on the Ottawa River about 10 miles northwest of Canada's Chalk River atomic research plant. The new power project, to be completed in 1958, has been designated NPD, which means Nuclear Power Development.

In discussing the construction arrangements for the project, Foster said that Atomic Energy of Canada, Ltd, had selected Hydro-Electric Power Commission of Ontario and Canadian General Electric Co, Ltd, "as the co-operating utility and manufacturer."

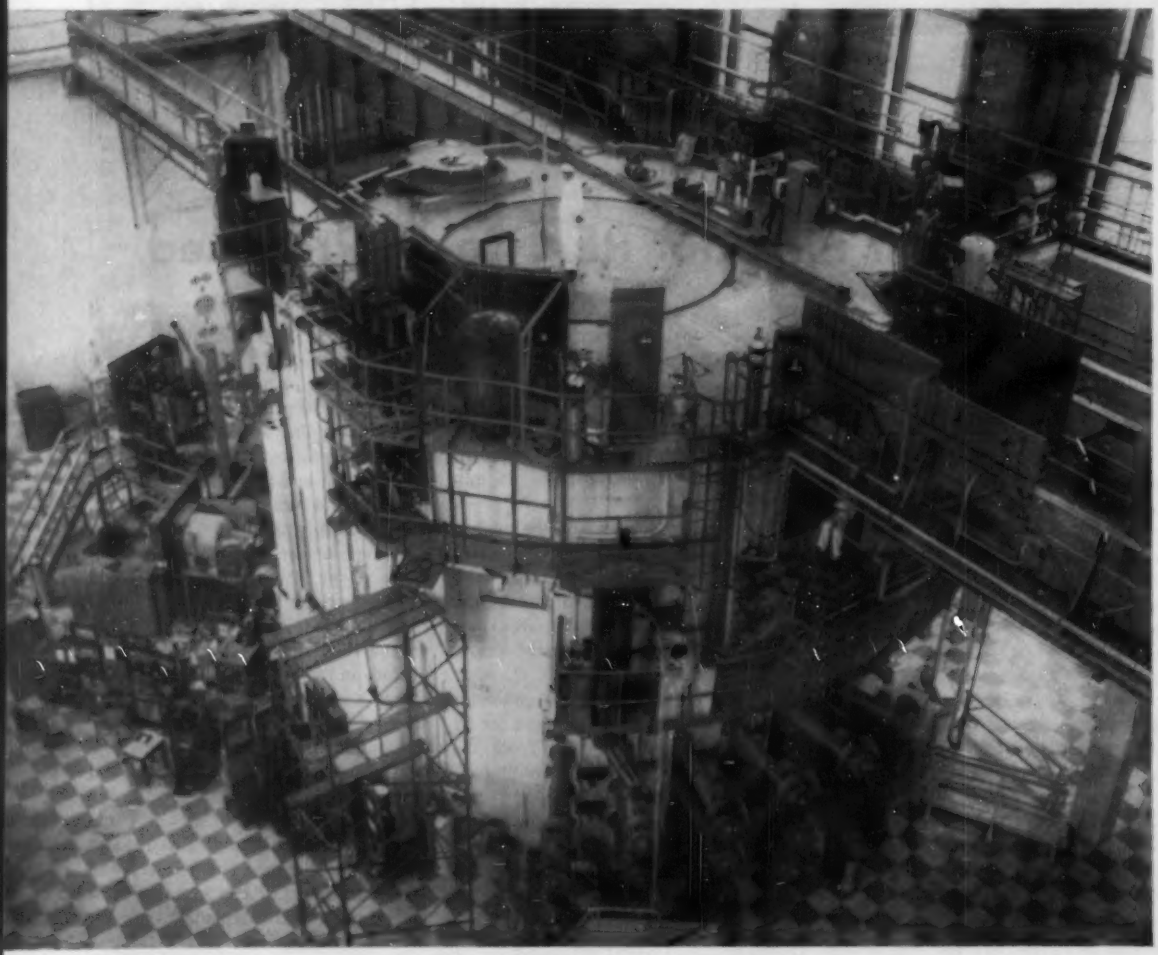
"AECL," he explained, "will purchase the reactor with all its auxiliary equipment and structures, provide advice and information, and finance all reactor development not borne by Canadian General Electric.

"Canadian General Electric will serve as prime contractors to AECL for the supply of the reactor plant and will contribute all engineering and development to a value of $2 million.

"Ontario Hydro will provide a site near their Des Joachims hydro electric development, will purchase the conventional plant and the building, operate the plant, and buy steam from AECL at an agreed rate."

Previously it had been announced that the total cost of the project would be $13-15 million and Ontario Hydro's share would amount to $3.5-5 million.

The following breakdown of project costs, exclusive of land and development expenditures, was presented by Foster: Reactor plant . . . $8 million;



EXPERIMENTAL REACTOR AT CHALK RIVER, OPERATING SINCE 1947, PRODUCES RADIOISOTOPES

conventional plant . . . $2 million; site improvements, buildings, and services . . . $1.3 million; total—$11.3 million.

Foster explained that the reactor type selected for the NPD "is one that employs natural uranium fuel in the form of metal rods immersed in a pool of heavy water moderator."

This type was selected, he said, because it promises "production of economic power" (and) "is better suited to Canadian resources since natural uranium may be used as fuel." He added that the technology of the selected design also is better known in Canada than that of other types because of past experiments.

Reactor Fuel Described

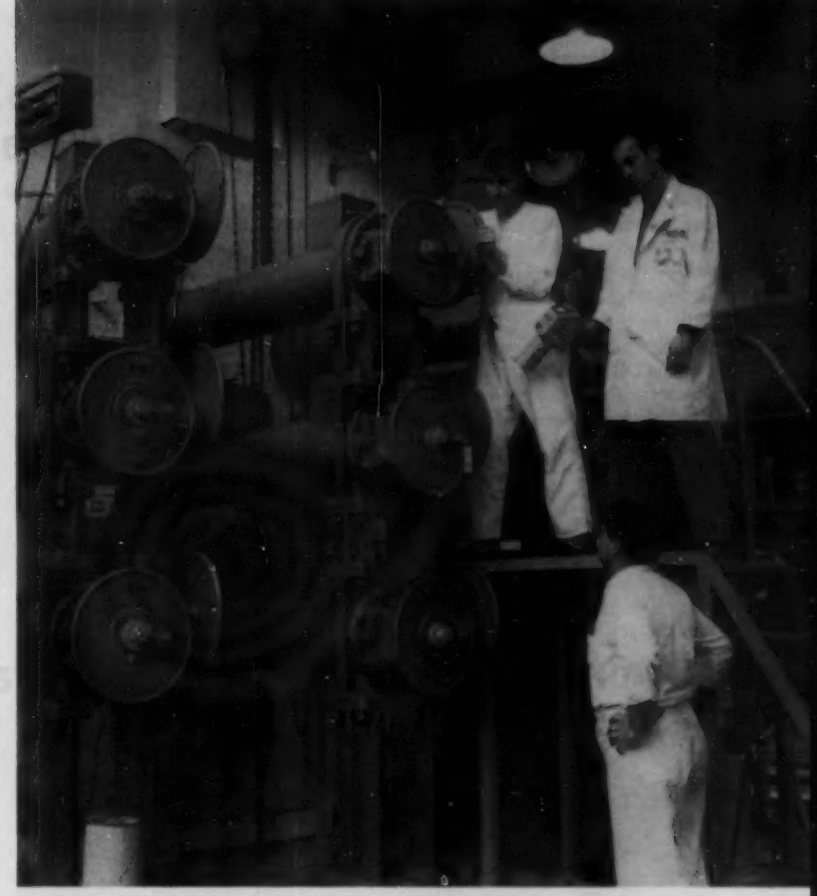
Describing the NPD reactor, Foster remarked, "To withstand water at more than 500F, its uranium fuel is clad in a zirconium alloy instead of aluminum. So that the heat can be taken away by water at this temperature without its boiling, the reactor will be contained in a steel pressure vessel and operated at 1200 lbs per sq in. or higher . . . the fuel rods are cooled with heavy water but . . . coolant and moderator are kept separate.

"This is done . . . because they are at two different temperatures — the coolant at about 500F, the moderator at between 60F and 260F."

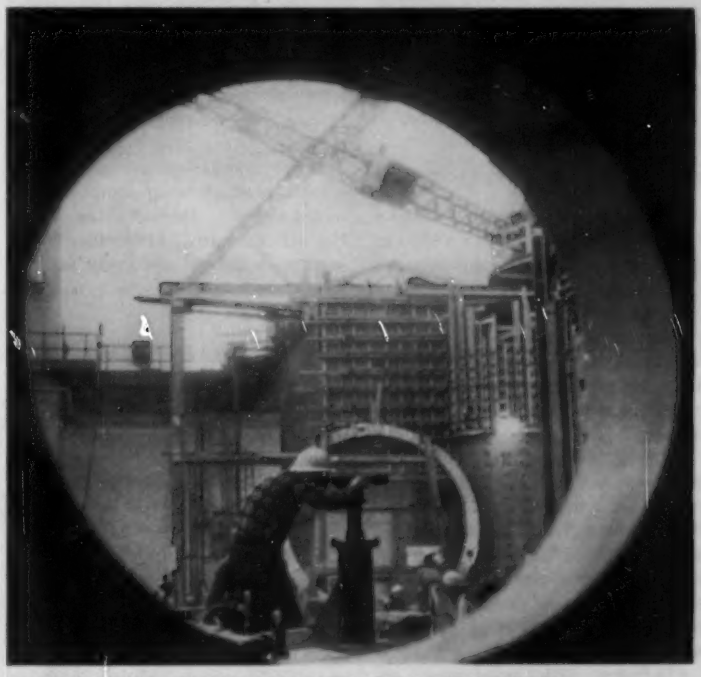
Liquid Moderator Plugged

"Liquid moderators," Foster pointed out, "have some disadvantages but they have one particular advantage. They permit the reactor to be controlled by regulation of the moderator. Consequently, reactors having liquid moderators use them for some degree of control, even if it is only to keep the reactor in a shutdown condition by draining them when they are not in use."

NPD's geneology, Foster said, included Canada's third reactor, NRU, now under construction and scheduled for operation next year. The NRU, he observed, "is being built to provide an even greater neutron flux, and, consequently, it produces more heat . . . the fuel rods are subdivided to present more surface for heat removal . . . the fuel is clad in aluminum."



WORKMEN EXTRACT RADIOISOTOPES FROM CHALK RIVER REACTOR



CANADA'S THIRD REACTOR, NRU, NOW UNDER CONSTRUCTION

Pennsylvania P&L Plans Nuclear Plant

Plans to construct a privately financed atomic power plant of at least 150,000-kw capacity have been announced to the Atomic Energy Commission by Charles E. Oakes, president of Pennsylvania Power & Light Co.

In notifying AEC Chairman Lewis L. Strauss of PP&L's decision to build an atomic plant, Oakes disclosed that the utility had entered into a contract with Westinghouse Electric Corp as co-developer. A homogeneous-type reactor will be used, the utility president said.

The joint program, known as the Pennsylvania Advance Reactor (PAR) Project, is the result of a study agreement with AEC.

"PP&L," Oakes said, "for sometime has been hard at work on studies . . . of the potentialities of atomic energy as a heat source for electric power generation and, more recently, has been making studies of the various types of nuclear reactors. Our research leads us to the conclusion that the homogeneous type of reactor is economically a promising bet."

"In the homogeneous reactor," Oakes added, "the fuel is in liquid form. This liquid, in addition to containing the radioactive fuel, also includes coolant and moderator to control the fission process. The liquid circulates freely throughout the nuclear power plant's system and carries heat to steam generators. . . . The use of the liquid fuel system will permit the reactor . . . to operate continuously as new liquid fuel can be added while the reactor is running."

Oakes did not disclose the power plant site but stated, "Naturally, it will be located in our service area." He added that PP&L would "apply to AEC for the necessary licenses." A 1962 project-completion date has been set.

Britain Pushes Atom as Marketable Product

LONDON (McGraw-Hill World News Bureau)—The atom in Britain has moved out of the laboratory and on to the sales counter.

The official view of the atom as a business is the same as that traditionally applied to pig farming: "Sell every bit and piece of it, and you can make it pay." A popular estimate holds that over the next 20 years nuclear exports for Britain alone will amount to $5 billion, with orders to start rolling in at Geneva's atoms-for-peace show and conference in August.

Atomic Program in High Gear

Britain's Atomic Energy Authority and industry, alike, think it's time to set up shop, and, accordingly, Britain's nuclear energy program has shifted into high with these developments:

- Another $168 million has been earmarked for three twin-reactor plutonium producing plants with work to start immediately and go ahead at full tilt.
- The government has announced that it will buy all used fuel elements and has set a trade-in price.
- Technical Irradiation Group has been established at AEA's Harwell research center to find new ways, and tell industry how, to make money with fission products from used fuel elements.
- Industry, with government approval, is going to Geneva with open order books for listing everything from Geiger-Mauller counters to full-scale atomic power plants.

All AEA's know-how, excepting only the most highly classified material, usually of a military nature, has been turned over to industry. Special training courses are being run at Harwell. Some are booked eight months in advance. Technicians from industry spend months working with Harwell scientists, digging into every phase of reactor development and radiation technology.

Many companies are already in volume production on equipment designed either by themselves or AEA's Harwell scientists. More than 95% of all material and equipment used by AEA is manufactured by private industry.

Who Sells What

The breakdown of who—government or industry—will sell what, is already clear. The government will keep a strict monopoly on the manufacture and processing of fuel elements. Similarly, AEA will be the sole British supplier of radiation sources, radioisotopes, tracers, and labeled compounds. But that is all.

Power reactors, radiation tools, instruments, special materials, everything else will be designed, developed, and sold by private industry, both on its own and under AEA contracts. All government patents have been made available to industry.

Fuel elements for private industry will be supplied by AEA, probably on a lease basis for both home consumption and export. An absolute condition will be that the used fuel elements must be returned to AEA for reclamation, processing, and resale.

The market for Britain's nuclear know-how is assumed to be everywhere. There is obvious interest throughout western Europe. And there's a real need. Nowhere are coal supplies really adequate.

Nearly every country has, or is building, a research reactor.

Market Expected

Britain expects its first business to come from the more highly developed countries in the Commonwealth such as Canada and Australia. Both are in need of atomic power and special agreements already exist with them.

Aside from the $5-billion, 20-year export estimate, there are no hard and fast estimates of how big the market will be in the immediate future. A fair indication, however, can be drawn from the volume of Britain's electrical plant, hydro, and internal combustion exports which topped $600-million in 1954. From Geneva on, the British exports should begin to include atomic power.

First Break in Copper Strike

. . . comes as Phelps Dodge reaches contract agreement with union; terms similar to those accepted by Anaconda in July

First major break in the nation's copper strike came last week with contract agreement between Phelps Dodge Corp and International Union of Mine, Mill and Smelter Workers, Ind.

Settlement was on terms almost similar to those agreed upon early in July between the union and Anaconda Copper Corp, only major producer that was not struck by the union. Last word from Kennecott Copper Co and American Smelting and Refining Co, however, gave no hint that a settlement was imminent. Kennecott and the union are still negotiating. American Smelting "may resume" negotiations this week with the Mine-Mill union.

Although Phelps Dodge has settled with the union at the mine, resumption of production must await settlement at the company's El Paso, Texas refinery. This was expected to come soon.

Both the Anaconda and Phelps Dodge settlements provided for wage increases ranging from 11½¢ to 17½¢ an hour. Major difference is in the health and welfare provisions of the Phelps Dodge contract. Mine-Mill had sought 20¢ an hour plus fringe benefits.

Electrical Industry Suffers

The industry strike, underway since July 1, has been costing the nation about 15,000 tons of copper weekly. Impact on the electrical industry is apparent when it is realized that 50% of this production goes into electrical wire products and a good deal of the remainder into bus bars and other electrical end-use products.

Copper supplies had been tight at most of the larger wire mills for some time before the strike and inventories of finished products are virtually nil. According to the monthly Copper Institute statistics, stocks of refined copper at end of June totaled 38,533 tons, the lowest figure for the year to date.

Although foreign copper supplies are available, American firms are reluctant to pay the premium price, reportedly as high as 51¢ a lb. Domestic price is 36¢ a lb.

At press time, Revere Copper & Brass Co, Rome Cable Co, Chase Brass & Copper Co, and other firms, had suspended operations due to shortage of metal. General Cable Corp resumed limited operations August 1 after a two-week shut down. The company reported it was buying some copper at premium prices and was also receiving supplies from sources other than its usual suppliers.

Although Revere Copper has suspended operations, the company is planning to resume limited production at some brass making sections in its Rome, N. Y., plant. A moderate improvement in the flow of brass and copper scrap has necessitated the decision. A Revere spokesman said operations would proceed "as long as we can get scrap material and to the extent it is received," in order to "help alleviate the unemployment situation."

A number of wire products manufacturers have increased their prices. But, they point out, this is not the result of buying premium copper. These increases reflect their own increased labor and other costs. Wage increases at the mines, therefore could mean further price increases eventually. Some industry observers are convinced that the 36¢ domestic price cannot be maintained and that it will go to 42¢.

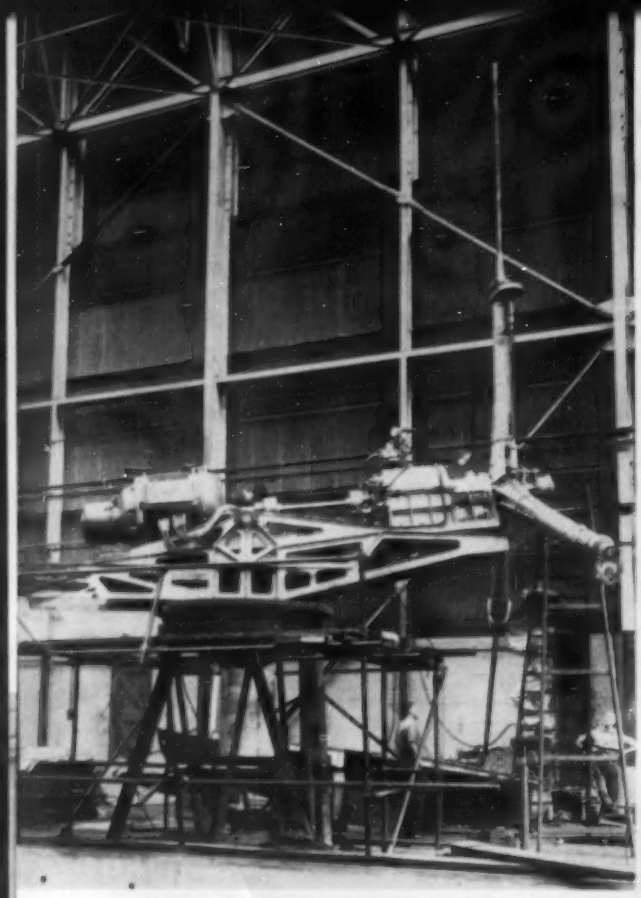
Rome Cable has increased prices on wire and cable products. Bare copper wire is up 1.4¢ a lb, magnet wire 2¼¢, weatherproof wire 1.5¢, and all insulated cable products 2%-9%. General Cable has increased its prices about the same as Rome Cable. Mueller Brass has lifted brass rod prices 3.86¢ a lb and seamless copper tube by 6¢ a lb. Other companies are expected to follow suit.

Dry Ice Cools Con Ed's Cables

Consolidated Edison Co of New York, Inc, has been on a beat-the-heat spree ever since a series of underground-cable burn-ups crippled service in its Brooklyn area during a July hot spell (EW, July 18, p 10).

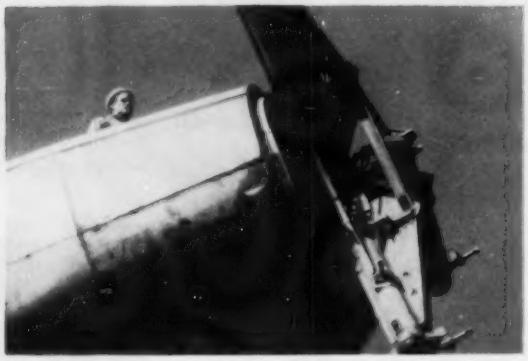
Workmen are shown above dumping chunks of dry ice into one of the hotter manholes. Improvised cooling techniques also include the provision of extra ventilation for some tunnel sections and the installation of blowers in others.

A company spokesman commented that the use of dry ice was more an expedient than an experiment. Regardless of label, the technique apparently had been successful. For although temperatures and load demands continued to soar in the New York City area, Con Ed reported that no crises had arisen since the July burn-ups.



WINDMILL MACHINERY for the 100-kw wind-powered electric generator was given trial erection in manufacturer's plant

VIEW OF COMPLETED wind-powered electric generator showing nacelle and blades. It was erected at Costa Head, Orkney



WORKMAN standing on hub of windmill's wind head is small by comparison with unit whose blades sweep 50 ft diameter

English Windmill Generates 100 Kw

GENERATION
Design

Unit, completed after four years of trial and error, will feed into Scottish power network; manufacturer plans 250-kw model

What is said to be the most powerful windmill in the world for the generation of electricity has just been completed in Scotland. It is a 100-kw unit on 400-ft high Costa Head on the Orkney mainland (EW, April 13, 1953, p 32).

The windmill was designed for the North of Scotland Hydro-Electric Board to feed into the local electricity network which is normally supplied by diesel engine generators. It took the engineers, John Brown & Co, four years to build and get the windmill running satisfactorily.

Specifications called for a windmill to generate 100 kw when the wind speed was 30 mph or above, and a correspondingly reduced output when the wind speed was below 30 mph. This meant the blades had to sweep a diameter of 60 ft. Later this "rated wind velocity" was increased to 35 mph, thus allowing the swept diameter to be reduced to 50 ft.

The windmill consists of a steel tower of such height that the center of the rotor is 78 ft above ground. A nacelle on top of the tower carries the rotor with its three blades and a step-up gearbox which increases the speed from the hub (130 rpm) to 750 rpm—the speed suitable for driving the electric generator.

The nacelle is mounted on a pintle shaft to allow the windmill to be yawed around to suit wind direction.

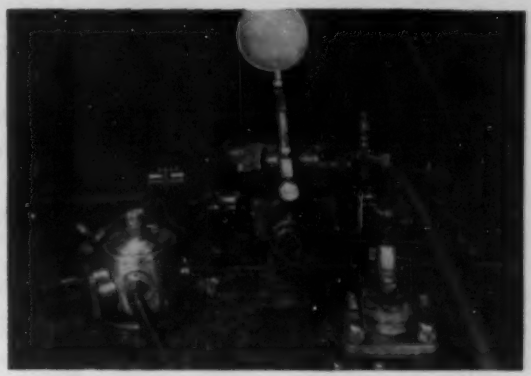
The machine is fully automatic and starts and stops itself untended as and when required by prevailing winds.

The windmill has three 17-ft long blades attached to a three-armed hub so that the swept diameter is 50 ft. The blades are of compressed laminated wood with high tensile steel fittings. There is a small "pilot" windmill mounted on the top of the nacelle which turns at a speed proportional to the wind velocity and tells the main control gear when to start or stop the windmill.

The main switch and control gear are housed in a stone building at the foot of the tower. The main electric power and other circuits are conveyed through cables running up one corner of the tower through slip-rings which allow the nacelle freedom to yaw.

Construction presented a number of problems. While Costa Head's winds are ideal for power, they also meant trouble during construction. The windmill blades caught the full

DAMPER GEAR at end of hub leg prevents excessive vibration by controlling movement of the blades on their hinges



CLUTCH CONTROL gear shown here is used to prevent windmill starting from gust of wind in otherwise calm period

REGARDLESS OF WIND SPEED, rotors will gather speed at a pre-determined rate controlled by governor shown in hub

force of the gales—and so did the men who were installing it. They had to cling grimly to the top of the tower in icy blasts. In one storm, wind velocity was over 125 mph. Conversation was virtually impossible, and often thick mists cut visibility on top of tower to a few feet. Damp, salt-laden air corroded metal, caused trouble with electrical insulation.

One of the biggest problems to overcome was the intense vibration set up when the windmill was started. This almost led to abandonment of the project. After months of trials, errors, and adjustments, the problem was solved. Use of hydraulic dampers and shortening of blades were large factors in reducing vibration.

The work and experience has proved of value. Confident that there is considerable scope in many parts of the world, and particularly in the north of Scotland, for large reliable windmills, John Brown is now designing a 250-kw model. The design will be greatly simplified as a result of the lessons learned at Costa Head.

Starting Procedure for the Windmill

To prevent a start from a gust in an otherwise calm period, the control gear, activated by the 'pilot" windmill (see main text), averages the wind speed over a number of minutes. Once the signal to start has been given, everything follows automatically in correct sequence controlled by the electrical relays in the control house.

1. With the clutch disengaged the generator is run up to speed as a motor and starts the oil pumps for main lubrication and the various hydraulically-controlled systems.

2. A brake on the rotor is released and the hydraulically-operated pitch-change mechanism gradually alters the pitch of the blades from full "feather" to fine pitch, thus enabling the wind to start up the rotor.

3. The rotor gathers speed at a pre-determined rate irrespective of the wind speed and under the control of the governor.

4. When the speeds of the rotor and generator are correctly matched the clutch is engaged to connect them mechanically.

5. The electrical control gear then measures the electrical output and cuts out resistance in the generator rotor circuit to adjust the governor so that the machine is made to carry full load.

Safety devices ensure that in the event of a failure in the connection with the electricity network, or any other mishap, the windmill will be brought to rest and prevented from restarting itself until the fault has been rectified.

Trailer Peddles Electrical Living

SALES
Residential-Rural

Kansas G&E is not waiting for the farmer to come to the city to buy appliances and farm equipment, it is taking them to him

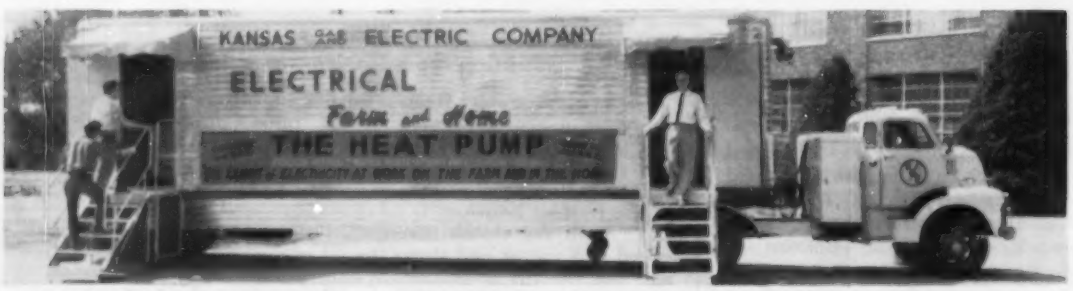
The old time peddler who carried his wares on his back had nothing on Kansas Gas & Electric Co's rural salesmen with the company's new trailer-mounted, traveling farm and home exhibit. With the trailer exhibit, the salesmen can display to the farmer and his wife a wide variety of electrical equipment including such devices as the heat pump. The heat pump is equipped with a plexiglass side which makes it a crowd-attracting display.

One side of the trailer is hinged at the bottom and swings down to form a stage. This is particularly effective for demonstrations before groups.

The exhibit van is 34 ft long, 8 ft wide, and 12 ft high. It is a semi-trailer van with cab-over-engine tractor. The 20-ft side panel which hinges down forms a platform 30-in. wide, extending out from the trailer floor 4 ft from the ground. An awning extends out 48 in., to cover the extended platform for use as an open, walk-past display or as a stage for demonstrations.

The display is also arranged so that audiences can walk through to view the exhibits during inclement weather,

KANSAS G&E'S VERSATILE TRAILER-MOUNTED TRAVELING FARM AND HOME EXHIBIT CAN BE USED FOR OPEN DISPLAY



WITH SIDES UP IN BAD WEATHER, IT PERMITS SMALL GROUPS TO WALK THROUGH AND VIEW ATTRACTIVE DISPLAYS

AT NIGHT EXHIBIT IS EFFECTIVELY LIGHTED. ISLAND LIGHT ON PEDASTAL AT THE RIGHT SUPPLEMENTS FLOODS

or for small groups when the side is not opened.

The trailer is adequately wired and lighted for almost any equipment. The wiring panel has a 200-amp entrance switch and a 30-circuit exhibit. In addition to serving the trailer, they demonstrate adequate wiring.

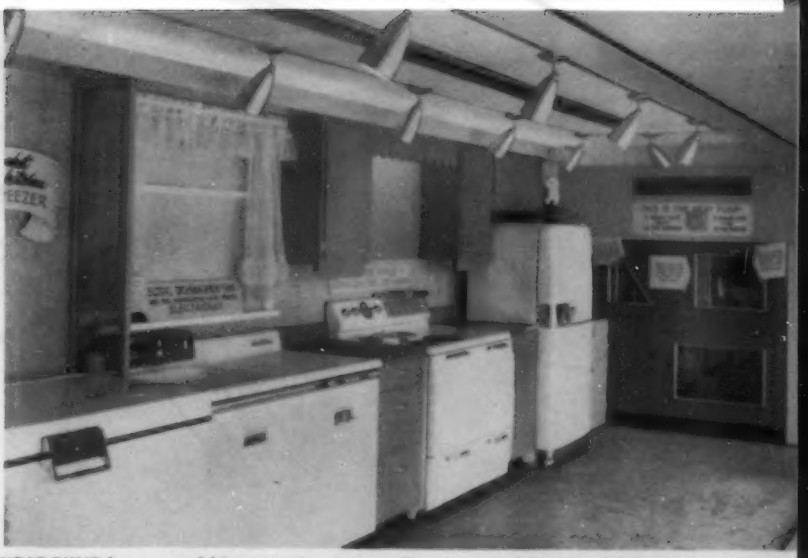
Four removable, self-standing display panels are set in front of the side that opens. They are arranged to show:

- Farm yard, home, and building lighting recommendations.
- Profitable uses for electric heat on the farm.
- How to save crops with electrical crop conditioning.
- The convenience of such equipment as a milking machine, milk pump, conveyor, auger, barn cleaner, silo unloader, and hay hoist.

Two removable, self-standing, lighted panels are set across the back of the van to show a vocational agriculture wiring board and 4-H farm and home electric projects.

Appliances Are Hooked Up . . . Major appliances displayed in the space along the closed side of the van include a range, water heater, refrigerator, freezer, dishwasher, automatic clothes washer, and dryer. All are operable and can be demonstrated for audiences.

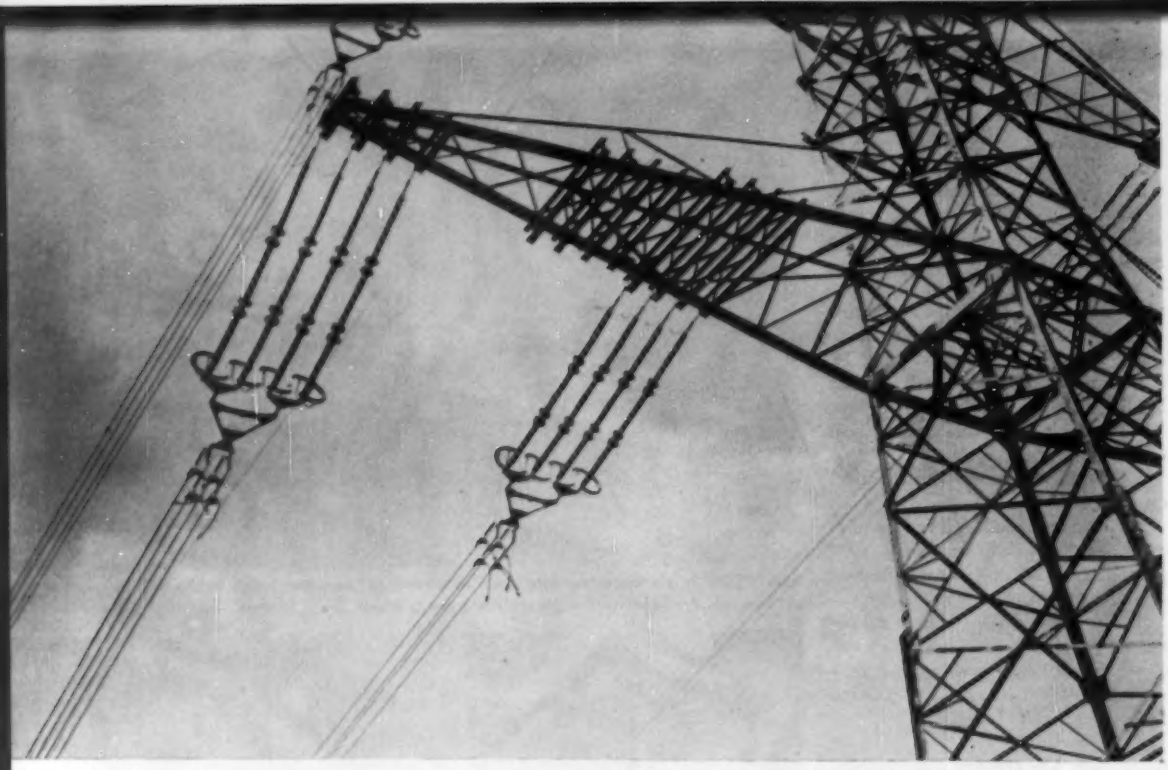
The van will be used to travel through the company's vast farming territory and particularly for display and demonstration purposes wherever farm people gather. In 1955, it is scheduled at shows and fairs where attendance will be approximately 100,000 people. The trailer also has been offered to the rural electric cooperatives which the company supplies with energy for showing at their annual meetings.



HEAT PUMP has proved big attraction in traveling farm and home exhibit. Interest has been added by the plexiglass panels which show pumps' working parts

INTERIOR VIEW shows the removable, free-standing farm application displays, left. Trailer is adequately wired and lighted, having 200-amp entrance switch

KG&E EXPECTS THAT THIS TRAILER WILL CARRY EXHIBITS TO ABOUT 100,000 PEOPLE IN FARM AREAS THIS YEAR



FOUR-CONDUCTOR BUNDLES, SUPPORTED BY STRAIN INSULATORS, ARE USED ON 380-KV LINES IN GERMANY

European Utilities Accept 380 Kv

TRANSMISSION
Design

Detroit Edison engineers find varied problems, including lack of right-of-way, is boosting the demand for extra-high voltage

L. W. CLARK, Assistant Manager of Operations, Detroit Edison Co, Detroit, Mich.

Facing the necessity of transmitting bulk power above the 120-kv level, Detroit Edison Co sent a team to Europe to examine designs of extra-high voltage lines and discuss operating experience with engineers in charge of them.

Great Britain, France, Switzerland, Italy, Austria, Germany, and Sweden have been familiar for some years with transmission operations in the 220-440-kv range. Accordingly, these company engineers—H. W. Collins, L. I. Komives, and the author—visited these countries to obtain first-hand information on EHV transmission developments.

Detroit Edison's system peak load was 300 Mw in 1923, at the time of installation of its 120-kv lines supplied by four generating stations not too far from the load center. Now with a peak load of 2,200 Mw supplied by five generating stations and continued load growth expected, the company is considering a higher bulk power system voltage to accommodate more distant generating stations in the future. Difficulty in obtaining enough rights-of-way has whetted the company's interest in higher-voltage lines with resultant greater capacity.

The engineers' visit to Europe had for its prime purpose the preparation of the company for deciding at what higher voltage it would operate its own future bulk power transmission system.

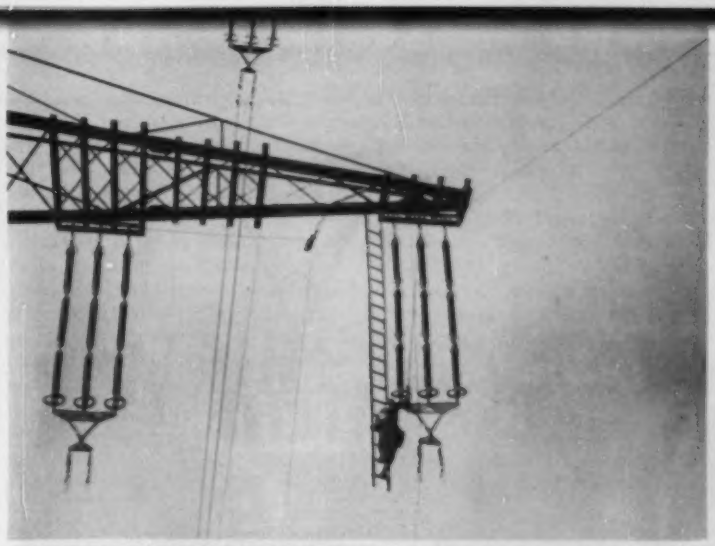
EHV Economics Studied . . . The visitors found quite universal acceptance of a nominal voltage of 380-kv

Comparable Designs for Ice Loading Between Twin-Conductor and Four-Conductor Bundles of German Transmission Lines

No. of	ACSR	Diam	Weight of Cond per cond	Weight of Ice per cond	Total Weight Ice and Cond per cond
Conductors	Sq mm	mm	Kg/m	Kg/m	Kg/m
4	240/40	21.7	0.9525	0.84	1.8
4	210/50	21.0	0.9548	0.83	1.8
2	447/143	32.0	2.4	1.02	3.4

for bulk power transmission abroad. They were able to satisfy themselves that transformers, circuit breakers, and other electrical equipment, as well as overhead transmission designs, are available in western Europe for reliable operations at this voltage.

Based on what was learned from various foreign operations, the team is convinced of the merit of adopting the highest voltage that shows reasonable overall costs. Both British and Swedish engineers told the team that they regretted not having gone higher in their moves from 132 to 275 kv and from 230 to 380 kv, respectively. Detroit Edison's engineering department, in its present studies of system requirements over the next 25 years, will delve into the economies of voltages from 220 to 440 kv.

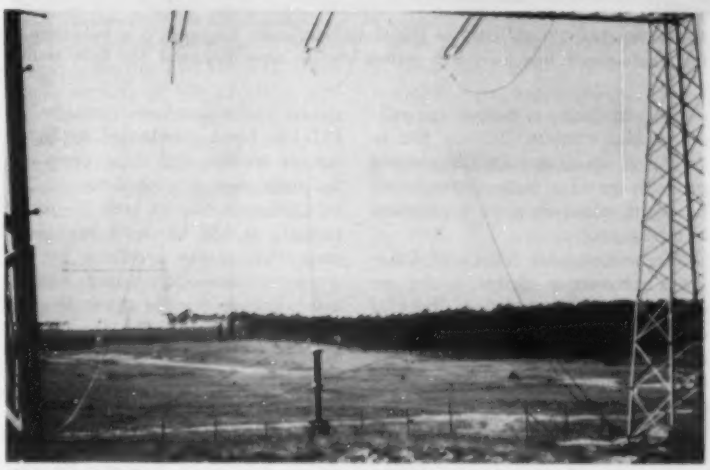


CYLINDRICAL SUSPENSION INSULATOR on 380-kv, four-conductor bundle, double-circuit line near Mannheim, can be measured against the man on a ladder

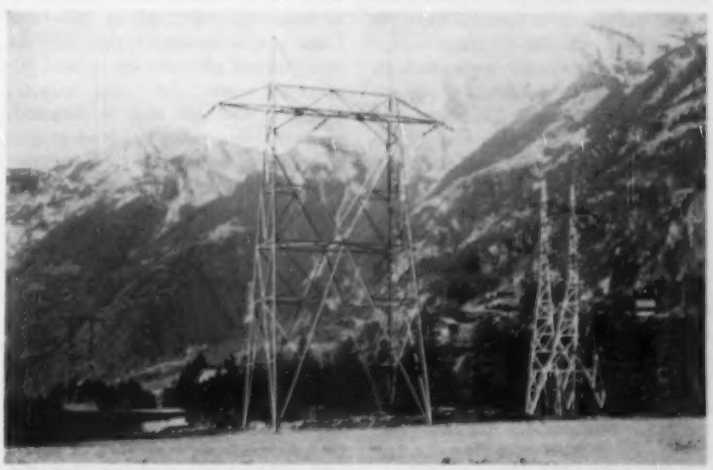
Philosophy Lags Designs . . . Several countries visited are or will soon be in the same position as Detroit Edison in its present pursuit of a higher voltage level. The situation in the British Isles closely parallels that in the Detroit service area. Large amounts of power must be transmitted over relatively short distances where it is very difficult to secure rights-of-way for the required number of 132-kv lines. Britain's investigation showed that the cost of a higher-voltage system would be no more, and probably would be less, than that of an equivalent 132-kv superimposed system.

The 220-kv transmission, tying together the continental power pool of 22,000 Mw, is now considered too low to meet load requirements visualized for the near future. The pool is supplied by hydro and thermal generation. As there is not too much water storage, hydro plants can use water only a part of the year. Thus the large flow of power is from the hydro-generating areas to load centers in seasons when water is available but reverses when water is scarce. Engineers of pool companies, having agreed on 380 kv as the proper voltage, are building lines and buying equipment which will be in operation in a year or two as the start of a 380-kv general network for all western Europe.

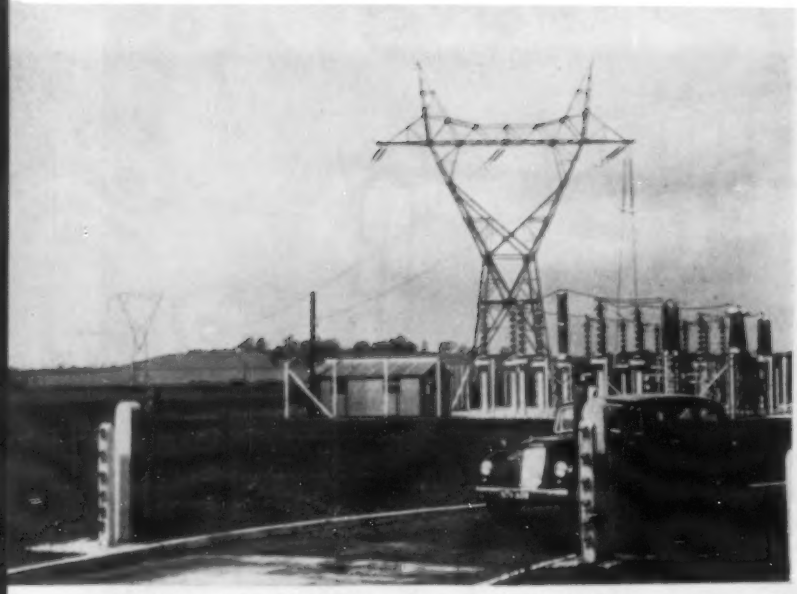
In Sweden some 1,200 miles of transmission lines operate at a maximum voltage of about 400 kv. The Swedish problem is transmission of large amounts of power from hydro sources in the north to load centers about 600 miles away in the south. The Swedes have about two years' ex-



TEST VOLTAGE can be varied on German twin-conductor, 380-kv, single-circuit experimental line. Voltage changes are made in 5-kv steps from 150 to 500 kv



CONCRETE-FILLED tubular steel structures, a feature of Swiss transmission, have high resistance to avalanches in Alps. The circuit shown is at 220 kv



EXPERIMENTAL 275-KV LINE at Staythorp, Midlands, England, is a twin-conductor single-circuit line having a testing station near midpoint for field testing

perience operating at that voltage without serious troubles. If they had to do it over again, they say, they would probably go to a higher voltage, believing it would be more economical in the long run.

The predominant feature of European transmission design is the accepted use of bundled-conductor construction with two, three, or four conductors per bundle. It is European opinion that such construction reduces line reactance.

Equipment Available . . . Circuit breakers, transformers, and lightning arresters are available for high-voltage operation in Europe where many manufacturers have new facilities for testing up to the 400-kv range.

Air-blast, oil-poor, and bulk-oil breakers are all used. The bulk-oil type is used the least. Air-blast and oil-poor types are fairly evenly divided although the former is a slight favorite at the higher voltages. Probably a more reliable breaker, the air-blast type requires a higher maintenance skill and usually costs more.

Autotransformers and two-winding transformers in large sizes are used for voltage ratios up to 3 to 1. Beyond that ratio, costs favor the two-winding type. High-voltage transformer impedances are generally in the range of about 8% for autotransformers and 13% for two-winding transformers.

The British grid was originally designed for transmission voltages of 132 kv. Load growth led to higher voltage studies, and three years ago the decision was reached to use 275 kv. Although heavier lines of greater capacity at 132 kv could have been used, right-of-way problems for the greater number of lines needed at the lower voltage favored fewer lines at the higher voltage. The actual costs of transmission at the two voltages were about a stand-off, a slight edge perhaps favoring transmission at the higher voltage.

Transmission at 380 kv was seriously considered, but the development of satisfactory insulation and equipment was not far enough along to make the full jump at that time. Load studies indicated that 275 kv would prove adequate for at least another ten years.

In the southern half of England, where heaviest industrial load growth is expected, tower lines are designed for future 380-kv operation. Sufficient horizontal spacing and insulator improvements in the next five years are expected to permit operation at 380 kv with existing vertical spacing. In the northern part, towers are designed for 275-kv operation only. Double-circuit construction is used in both areas, and twin conductors on 12-in. spacing are common design features.

Design Standards Employed . . . British standard construction for the straight 275-kv double-circuit lines is twin ACSR conductors of 0.175 sq in. equivalent copper section with a thermal rating of 800 amp, 375 Mva per circuit. For the 275/380-kv lines the British use twin ACSR conductors of 0.4 sq in. equivalent copper section with a thermal rating of 1,200 amp, 570 Mva per circuit at 275 kv and 750 Mva at 380 kv. The 275-kv lines normally are operated at 50 to 75% of thermal rating, 75% being the most economical point. To date they have one 20-mile experimental single-circuit line in operation at 275 kv.

The British expect no serious trouble from radio or television interference on the twin-bundled conductors at the higher voltages. Their tests indicated that going to bundled conductors affords advantages justifying the slightly greater expense over a single conductor at 275 kv. At 380 kv the bundled conductors are even more necessary.

The British stated that they do not expect serious difficulty in load divisions between parallel ciruits or groups of circuits at 132 and 275 kv. They cited a specific case of expected parallel operation of a 275 with a 132-kv line for a distance of 40 miles. Compared with the 132-kv line impedance, total impedance of the higher-voltage line, together with its autotransformers at each end, was such as to give very nearly the desired load division between the two circuits. As more 275-kv lines are inserted in the grid, the British expect to remove 132-kv lines and use them as radial feeders rather than as part of the parallel grid system.

French Look to 380 Kv . . . The French, having 225-kv lines, are looking towards 380 kv. Their standard 225-kv design is double circuit on an H-frame construction suitable for later conversion to single-circuit 380-kv operation. The conductor is ACSR with 326 sq mm of aluminum and 85 sq mm of steel good for 400 Mva (total for the two circuits) at 225 kv and 600 Mva (one circuit) at 380 kv with twin-bundled conductors of the same size at 40-cm spacing.

While, like the British, the French expect to go to twin-bundled conductors for 380 kv, one French engineer expressed his opinion that single conductors of larger diameter might prove adequate and more economical. For the same radio interference factor, a 1.6-in. dia ACSR single conductor, he indicated, would be equivalent to 1.05-in. dia ACSR twin conductors at

40-cm spacing. The greater reactance of the larger single conductor would not be serious for short bulk-power transmission.

The French, nevertheless, are planning to go to twin conductors at 380 kv. The single 1.6-in. dia conductor would be good for 400 Mva at 380 kv, compared with 600 Mva at 380 kv for the 1.05-in. twin conductors.

Swiss Think 220 Kv Adequate . . . Swiss transmission is 50, 150, or 220 kv. The Swiss think 220 kv will always be adequate for their small country. However one or two main north and south lines from Italy across Switzerland to the Ruhr region in the north someday will probably be twin-conductor 380 kv. While some 150-kv lines are designed for future 220-kv operation, nothing is yet built for future 380 kv.

An interesting development in Swiss tower-line construction is the use of concrete-filled steel tube towers. Often tubular sections are filled with concrete during erection, and at other times a layer of concrete is spun on the inner surface of the tube before fabrication. Concrete filling or lining greatly increases tube strength, and the finished tower is somewhat streamlined in appearance. Such towers are less susceptible to avalanche damage than conventional towers.

The Swiss report cost savings of 10, 12, and 14%, respectively, for 130, 220, and 380-kv towers, compared with angle-iron construction. Spun concrete with a thickness of 17% of the diameter of the tube trebles the strength of the base tube.

Italians Consider 380 Kv . . . Italian engineers are giving thought to 380 kv although the present highest transmission voltage is 220 kv. At that voltage, the Italians use both twin and single-conductor construction. The first twin-conductor line has been in service since early 1953.

While rigid 15-in. spacers were used at about 250-ft intervals early in the construction of the line, they had to be replaced with the articulated type which allows for longitudinal movement of the conductors. And at span centers and in areas where wind and icing were prevalent, it was necessary to reduce the spacing to about 100 ft.

The Edison of Milan engineers favor single-conductor construction in the severe icing regions of the Alps, even for 380 kv. They prefer twin-conductor arrangement for the more inhabited, milder sections of the country, where radio interference must be considered although their standards of radio interference are probably not so high as ours.

In Italy a simple flexible type of spacer for twin conductors has been developed and is known as the Salvi Spacer. It consists of line clamps applied to both conductors and held apart by a circle of galvanized steel stranded wire.

Austria Has 220 Kv . . . Austria's maximum transmission voltage is 220 kv, and there appears little likelihood of anything higher in the immediate future. Later interconnecting lines of 380 kv may be needed between Germany and Yugoslavia.

Germans Bundle Four Conductors . . . The West German transmission system is fundamentally 220 kv, with a few lines operating at 300 kv. Nine utilities operate the German network. These have agreed upon 380 kv as the future standard voltage of their interconnected systems. Equipment is on order, and lines are under construction for operation at this voltage. Lines of this future 380-kv system are now in temporary use at a lower voltage.

Perhaps the most interesting feature of the German system is its adoption of the four-conductor bundle because of its lower reactance and reduced radio interference. Many lines traverse heavily populated areas, such as American engineers are faced with in Michigan where radio interference is important.

The Germans could not say just how much better the four-conductor bundle is compared with twin conductors. They pointed out that it does increase total line cost, including right-of-way costs, by only 2% and boosts the carrying capacity of long lines from 500 to 600 Mw because of the lower reactance. These were considerations sufficient to sell them on the four conductors. They will use twin conductors, however, in sparsely settled areas where icing is a problem and radio interference is less important. The table compares the twin-conductor and four-conductor-bundle designs on the basis of ice loading.

The Germans have a center near Mannheim for testing different types of line construction at voltages up to 500 kv. A twin-conductor line has been tested, and they have completed a four-bundle conductor line which will be tested soon. These tests will provide strictly comparable data on both construction types.

Right-of-Way Problems . . . Obtaining adequate right-of-way space is as difficult in Germany as it is here. German practice affords an interesting comparison between the space required for transmission of 1,200 Mw at 220 kv and at 380 kv. Four double-circuit 220-kv tower lines require a right-of way width of 410 ft. One double-circuit tower line at 380 kv needs only 217 ft.

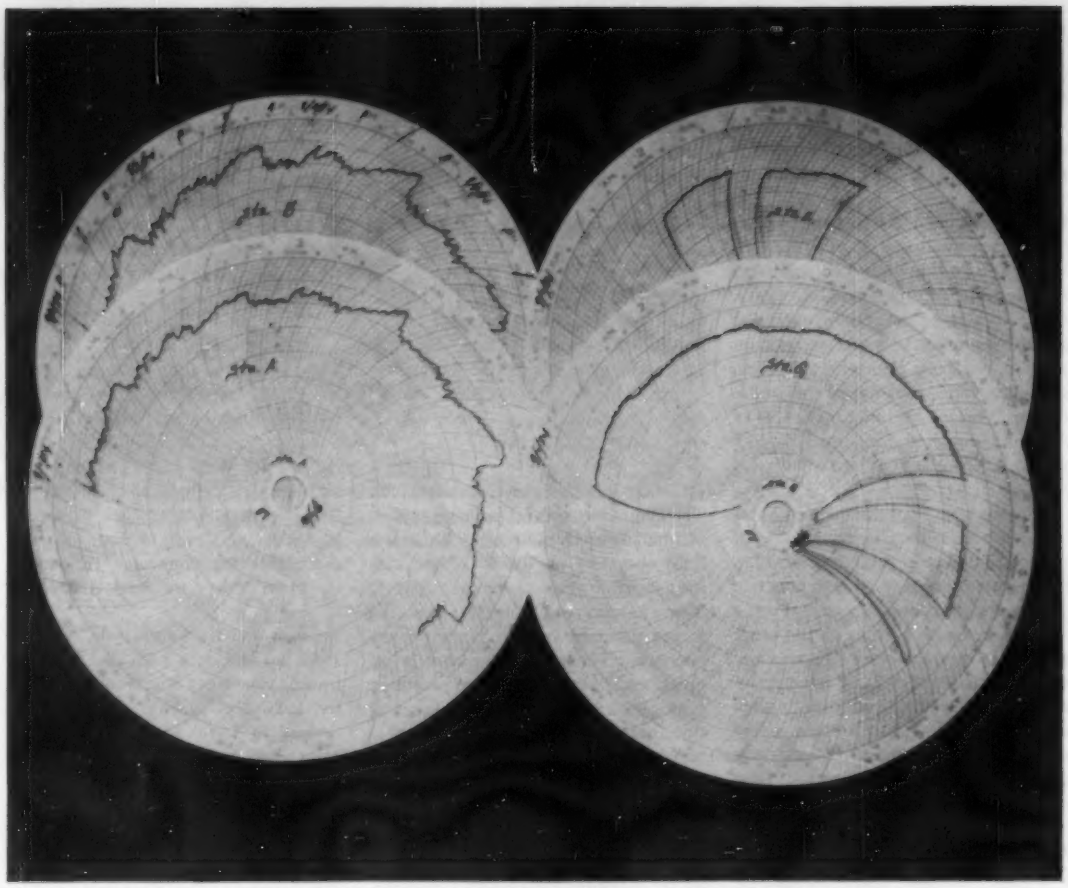
The German line insulator is of a different type than that in common use elsewhere. They report that the ordinary cap-and-pin-type insulator was so troublesome that they have substituted for it as standard equipment a column or cylindrical insulator. At 380 kv, three columns are suspended in series, and two to four of such assemblies are connected in parallel to obtain desired mechanical strength.

Swedish 400 Kv Successful . . . Since 1952 Sweden has had 600 miles of transmission lines operating at 400 kv. By 1956 this mileage will have increased to 1,700. Sweden's need for extra high voltage is somewhat different from ours. Their line lengths are much longer, their hydro stations in the north being some 500 or 600 miles from main load centers in the south.

When the Swedes first considered a transmission voltage higher than 220 kv, they made economic studies, comparing voltages of 220, 330, 380, and 440 kv. They determined that for their conditions 380 kv was the most economical. Since their 380-kv line went into service, the Swedes have gradually increased their operating voltage until they are actually operating at a maximum of 400 kv.

Sweden has H-frame, single-circuit construction with twin conductors, each 0.92 sq in. ACSR, hung in a horizontal plane with about 18-in. spacing. Although they are entirely satisfied with the twin-conductor arrangement, the Swedes are considering adding a third conductor for greater line capacity and lower reactance.

Sweden's satisfactory experience with 400 kv is an important factor in the willingness of Detroit Edison to consider this range of voltage for its own future program.



CHARTS OF VOLTAGE AHEAD OF REGULATORS, SWITCHED CAPACITORS (L), ON FEEDER (R) PROVE . . .

Capacitors and Regulators Effective

DISTRIBUTION
Operation

Public Service Co of Oklahoma after tests finds them to be solution to voltage problems brought by air conditioning loads

WENDELL C. FOWLER, Manager, Southwest District, Sangamo Electric Co, Fort Worth, Texas and

C. W. THOMAS, Operating Superintendent, Tulsa Division, Public Service Co of Oklahoma, Tulsa, Okla

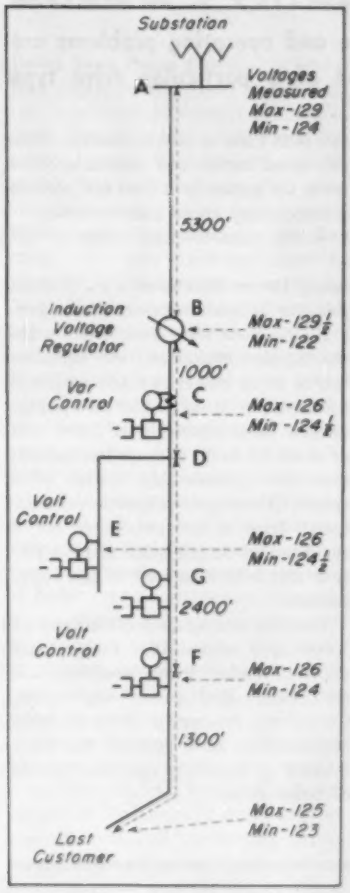
Public Service Co of Oklahoma tests during the changing system conditions of the 1954 heavy air conditioning season proved the effectiveness of installing switched capacitors at outlying points on a feeder. The tests were conducted at Bartlesville, Okla.

Capacitor switching was coordinated with an induction voltage regulator also out on the feeder, where the effect on voltage was as indicated in the graphic voltmeter charts.

In the circuit diagram of the feeder, capacitors at C, just beyond the induction voltage regulator station, had var-sensitive controls. But capacitor banks at points E, F, and G were equipped with voltage-sensitive controls of the thermal-demand type, which afforded sufficient delay in operation to eliminate pumping. Thus time delay before switching increased logarithmically as signal strength decreased. Such units made it possible to control several capacitor banks on the feeder so that capacitors were switched selectively to fit circuit conditions at any time.

Control signals were taken from one phase only, and signals at all points from the same phase. Load between phases was balanced by changing connections of transformers as far as practicable. This procedure contrasts with that in the substation where capacitor banks are switched by an operator as system conditions alter.

Narrow-Band Regulation . . . During the tests, the regulator, without com-



CAPACITORS at points E, F, and G are switched by voltage-sensitive control

THERMAL DEMAND TYPE METERS initiate the signals for switching the capacitors which have been installed at a number of locations out on the 4.16-kv feeder

pensation, responded to voltage changes originated by the switching of a capacitor bank. Action of the regulator in maintaining the output voltage constituted a negative feedback of the voltage signal. The net effect on voltage at the capacitors was only that of the capacitor current through the circuit reactance between regulator and capacitors. The voltage control required bandwidth only to exceed this net effect. It then served to provide compensation for line drop, holding a voltage contour that was substantially flat at all times between the regulator and the last capacitor bank.

Voltage limits were obtained on all the primary circuit within the control area when the regulator was set for 1.25% bandwidth and voltage controls for 1.67% bandwidth. Using the regulator with limits of ±5% where a range of ±10% was required previously to provide for the line drop compensation resulted in doubling the current-carrying ability of the regulator.

Additional Benefits . . . The circuit benefitted additionally from the use of a switched bank of capacitors with var-sensitive control connected immediately after the regulator. The control signal was obtained by measuring vars flowing out at that point. Within limits of the bank, a load of near-unity power factor was maintained for substation, regulator, and the circuit to the capacitor bank. Such conditions were maintained during the test with customer peak loads totaling 1,750 kva at 79% power factor and minimum loads during early morning hours of 715 kva at 77% power factor.

With this setup, substation and regulator, as well as generation and transmission facilities, saw loads of 1,375 kw on peak and 550 kw at minimum times, each at about unity power factor.

The saving in losses and equipment under these conditions is considerable.

Proves Economical . . . Switches, controls, instrument transformers, and installation costs were less than $2 per kvar, including the extra control of moderate-sized banks for making the test. These costs are considerably less than for controlling the same quantity of capacitors in a station with the necessary circuit breakers.

Adequate system information through sufficient instrumentation and careful engineering are requisites for successful application of such switched capacitors over the many circuits of an extensive system.

Choice of Power Plant Auxiliaries

GENERATION
Design

But space, location, maintenance and operating problems are other factors affecting selection of a particular drive type

WALTER PALMER, GAVIT, Consulting Engineer,

WALTER G. FRASER, JR, Power Engineer, United Engineers & Constructors Inc., Philadelphia, Pa.

Power plant auxiliaries of continuously changing load characteristics, such as boiler feed pumps and induced and forced-draft fans, present a wide choice of drives.

The selection of a particular drive type is primarily based on economics: It should offer lowest annual cost for predicted load characteristics. But space limitations, equipment location, maintenance and operating problems, inability to utilize exhaust steam from a driving turbine, operators' preference, and possibly variation in the future operating cycle frequently affect actual selection.

Basic Drives . . . Basic drives for boiler feed pumps are as follows:

1. Constant-speed squirrel-cage motor with feedwater regulator or with feedwater regulator and excess pressure regulator with valved bypass.
2. Constant-speed squirrel-cage motor with hydraulic or electro-magnetic drive.
3. Variable-speed steam turbine with integral speed controller.
4. Wound-rotor motor with step-type speed regulation and feedwater regulator or with liquid rheostat.
5. Dc variable-speed motor.

Drives for forced and induced-draft fans offer these basic arrangements:

1. Constant-speed squirrel-cage motor with fan damper control or with fan inlet vane or louvre control.
2. Constant-speed squirrel-cage motor with variable-speed hydraulic or electro-magnetic drive.
3. Wound-rotor motor with step-type speed regulation and fan damper control or with liquid rheostat.
4. Variable-speed steam turbine with integral speed controller, speed reduction gear, and fan damper control.
5. Two constant-speed squirrel-cage motors to give two-speed operation with fan damper control or with fan inlet vane or louvre control. (One two-speed motor can occasionally be used, but generally it does not provide a satisfactory speed combination).
6. Dc variable-speed motor.

Some Drives Precluded . . . Factors peculiar to modern power plants generally preclude some basic drives without detailed evaluation. An adequate source of dc power is rarely available for dc motor drives. Boiler feed pumps operate most efficiently at 3,600 rpm or above while the average fan installation has considerably lower drive speeds. The electro-magnetic variable-speed drive is not obtainable for a synchronous output speed above 1,800 rpm and is thus limited to fan applications.

The cost and space requirements of 3,600 rpm wound-rotor motors and control render them uneconomical for boiler feed pump application. Conversely, this type of drive warrants consideration as a possible fan drive because of the lower operating speeds of boiler fans.

Table I—Evaluated Annual Cost of Boiler Feed Pump and Boiler Draft Fans

Evaluation Factors:
a. 70% Annual Capacity Factor with 8000 Hr Total Operating Time
b. 12% Annual Fixed Charges
c. $.003 per kw. hr. Operating Power Cost (8000 × .003 × .746 = $17.90 per Input HP per Year)
d. 35% Turbine Drive Efficiency Compared to 70% for Main Generating Turbine (for the Same Possible Expansion, Turbine Drive HP. = .70/.35 × .985 × .98 = 1.93 Main Turbine HP, with 98.5% Generator Efficiency and 2% Distribution Loss)
e. $150 per kw Reduced Station Capacity Due to Furnishing Auxiliary Power (150 × .12 × .746 = $13.42 per Input Hp per year)

Application	Boiler Feed Pump			Boiler Draft Fans								
Drive Type	Const. Speed Reg. Valve	Hydraulic	Turbine	Const. Speed Damper	Const. Speed Inlet Vane	2-Speed Damper	2-Speed Inlet Vane	Hydraulic	Magnetic	Wound Rotor Step	Wound Rotor Liq. Rheo.	Turbine
Price	$52,900	$61,500	$46,020	$38,230	$38,750	$51,120	$51,640	$49,090	$52,905	$50,050	$54,150	$50,780
Hp Input	903	826	672×1.93 = 1297	623	522	414	359	493	193	473	162	312×1.93 = 602
Annual Cost												
Fixed Charges	6,350	7,390	5,520	4,590	4,650	6,140	6,200	5,895	6,350	6,000	6,500	6,100
Auxiliary Power	16,170	14,800	23,210	11,150	9,345	7,410	6,430	8,825	8,825	8,465	8,275	10,780
Reduced Capacity	12,120	11,100	17,410	8,360	7,010	5,555	4,820	6,620	6,620	6,350	6,210	8,080
Total	$34,640	$33,290	$46,140	$24,100	$21,005	$19,105	$17,450	$21,340	$21,795	$20,815	$20,985	$24,960

Based Primarily on Economics

Boiler Feed Pump Drives . . . Boiler feed pump capacity must be sufficient for boiler and blowdown demand at drum pressure when safety valves operate. It must be sufficient also for system friction losses and static pressure. Such pumps have excess capacity throughout the normal operating range and their discharge must be throttled in constant-speed operation. Variable-speed operation permits savings of all or part of this loss.

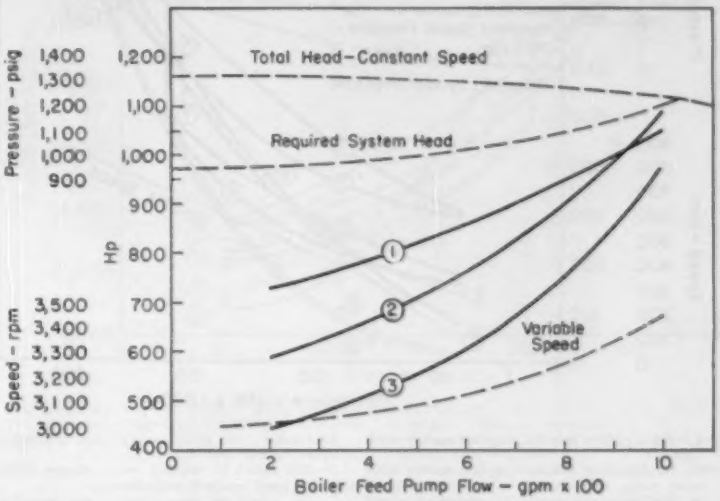
The characteristic pump and system head-capacity curves and input horsepower curves of Fig 1 illustrate the throttling loss, presupposing a constant suction pressure. Often the boiler feed pump suction pressure is related to condensate pump discharge pressure and heater friction, varying throughout the flow range. When flow is reduced, the pressure existing at boiler feed pump suction increases, thus reducing the head requirements of the boiler feed pump. This results in greater horsepower savings with variable-speed operation than indicated by the curves.

The table, evaluating drive combinations, is based on the assumed evaluation factors listed, which are subject to variations in prevailing operating costs and accounting procedures. Extensions of the calculations to cover other capacity factor values at the same hours of operation provide data for curves of annual cost vs capacity factor over a sufficient range to indicate any change in relationship between the drive types. Fig 2 shows the plot of the extended data for the representative pump selected, with drive combinations which generally warrant consideration.

Constant-Speed Pump Drive . . . Boiler feed pumps with constant-speed drive and regulator valve have an economic advantage over the variable-speed drives above approximately 5% capacity factor. Thus, when boiler feed pumps are rated only for operating demands of a base loaded plant, constant-speed drives are preferable economically.

Because the base load unit of today will not necessarily be such a few years hence, possibilities of operation within the economically justifiable range of variable-speed should be seriously considered.

Fig. 1 – Operating Characteristics of Constant and Variable Speed Boiler Feed Pump Drives



1—Hp input to constant speed motor with regulator valve
2—Hp input to constant speed motor with hydraulic variable speed drive
3—Pump bhp at variable speed and hp input of variable speed turbine drive

Variable-Speed Advantages . . . Besides the horsepower savings afforded by variable-speed drive, there are other important considerations. Variable-speed operation permits the pump to operate at the minimum speed consistent with flow requirements. Thus wear and maintenance on the pump are reduced to a minimum.

When feed flow is controlled by variable pump speed, the controlling mechanism is not in or affected by the water flow stream. Accordingly, the control mechanism is less subpect to corrosion or deposit of foreign material. Sticking and hunting are thus

Fig. 2 – Annual Cost vs Capacity Factor for Boiler Feed Pump Drives

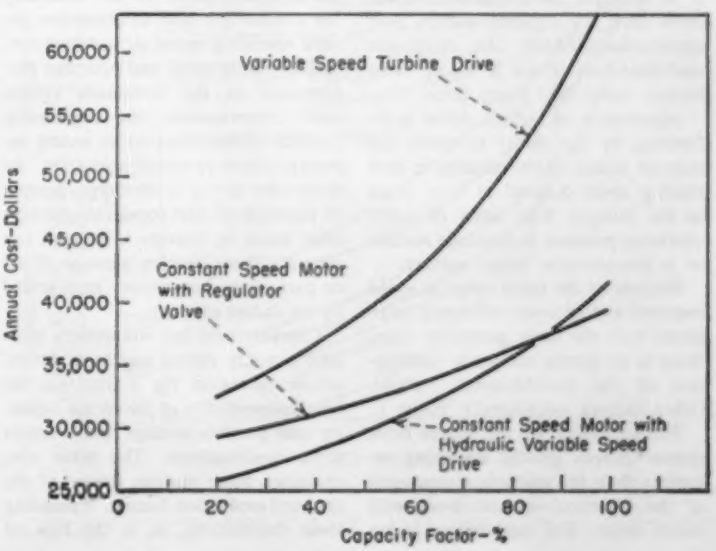
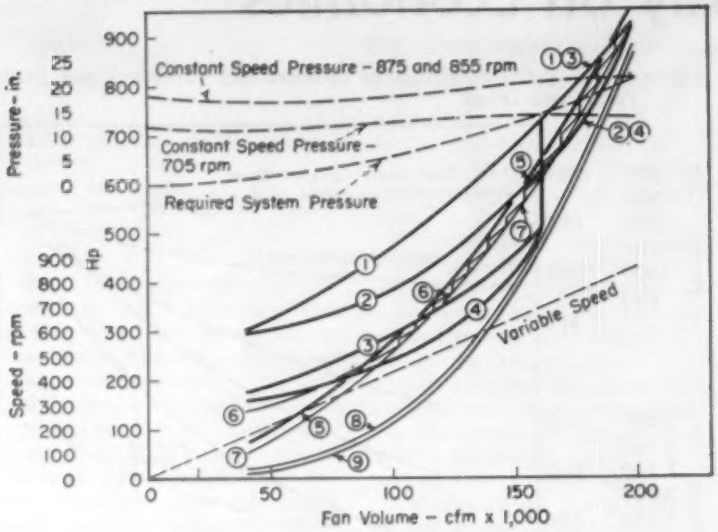


Fig. 3 - Operating Characteristics of Constant and Variable Speed Induced Draft Fan Drives


Pressure - in.
Speed - rpm
Hp
Constant Speed Pressure - 875 and 855 rpm
Constant Speed Pressure - 705 rpm
Required System Pressure
Variable Speed
Fan Volume - cfm x 1,000

1—Hp input to constant speed motor with damper
2—Hp input to constant speed motor with inlet vane, or louvre
3—Hp input to two (2) constant speed motors with damper
4—Hp input to two (2) constant speed motors with inlet vane, or louvre
5—Hp input to constant speed motor with hydraulic or electro-magentic variable speed drive
6—Hp input to wound rotor motor with step speed control and damper
7—Hp input to wound rotor motor with liquid rheostat control
8—Hp input or geared variable speed turbine with damper
9—Fan bhp at variable speed

eliminated and improved control characteristics obtained. When outage occurs with variable-speed operation, the usual multiple unit installation provides continuous, automatically controlled boiler operation.

Variable-Speed Pump Drives . . . Among variable-speed drives, the hydraulic type has the least annual cost. It is undercut by the constant-speed drive only for capacity factors over approximately 85%. Its economics and operation afford a highly satisfactory boiler feed pump drive.

Application of turbine drives is influenced by the ability to utilize the exhaust steam. This requires a feed heating cycle demand at least equal to the exhaust flow, units of lower operating pressure in the same station, or a low-pressure steam market.

Because of the small range of speed required and of lower efficiency compared with the main generator units, there is no purely economic justification of the variable-speed turbine. Other factors occasionally favor it.

The simplicity of the steam drive system affords greater operating reliability than the multiple components of the electrical system used with motor drive. For this reason, steam drive is often used for standby purposes, an application in which first cost is subject to economic evaluation. When improved efficiency warrants pump speeds above 3,600 rpm, cost and complication of a motor-gear combination favor the turbine.

Boiler Fan Drive Economics . . . Boiler fan ratings are selected to provide a theoretical amount of air necessary for combustion and to allow for desired operating excess air requirements, leakage, infiltration, and poor fan performance at the maximum system static requirements. As engineering practice dictates reasonable excess capacity, constant-speed operation requires the use of a discharge damper or variation of inlet conditions through inlet vanes or louvres to control fan output. These involve wastage of all or part of the horsepower represented by the excess capacity.

Characteristic fan and system pressure capacity curves and input horsepower curves of Fig 3 illustrate the loss representative of the excess capacity and possible savings with various drive combinations. The table also evaluates these various drives at the assumed evaluation factors. Extending these calculations, as in the case of boiler feed pumps, provides data for plotting annual cost vs capacity factor.

Constant-Speed Fan Drives . . . Boiler fans with constant-speed drives present economic advantages which cannot be disregarded. When operating conditions permit control of erosion and the vane, louvre, or damper bearing design is proper, the fastest control response is obtained. This is caused by the absence of fan inertia effect on the control element.

While the two-motor combination has an economic advantage for capacity factors below approximately 80%, its operating peculiarities limit its application. The change in speed should be so located that the low speed provides for the normal operating range and the high speed for overload and emergency conditions.

Any future change in either fuel or demand will alter the economics of initial selection of point-of-speed change. The control is more complicated than with single-motor operation. Closer coordination between forced and induced-draft fans is essential to prevent operating difficulties during speed change, and the two motors must be protected against simultaneous operation. The control problem is aggravated with increased inertia of the rotating elements. The two-motor arrangement, therefore, is usually limited to smaller unit sizes, and the single constant-speed motor with inlet vane or louvre control is more generally applied for constant-speed drive.

Between 80 and 100 capacity factor, the single constant-speed drive with inlet vane or louvre control has the lowest annual cost. Disregarding the two-motor combination for larger unit sizes, this economic preference extends between 70 and 100% capacity factor.

Variable-Speed Advantages . . . Variable-speed operation always presents a saving in horsepower. In addition, bearing wear and fan erosion are reduced. Controlling dampers and vanes or louvres, when not eliminated, are used only at greatly reduced speeds where erosion is minimal.

The principal control elements, being outside the gas or air stream, are less subject to corrosion or deposits causing sticking or hunting.

Variable-Speed Fan Drives . . . Application of turbine drive has the same

limitations as that of boiler feed pumps. Other than for standby service, it is economically feasible only for low capacity factors.

Over the range of capacity factors the other variable-speed drives present little economic difference upon which to base a selection. Therefore, choice of a particular arrangement is usually for reasons other than cost, such as operating preference. The exception is the wound-rotor motor with step-speed control and damper at lower capacity factors.

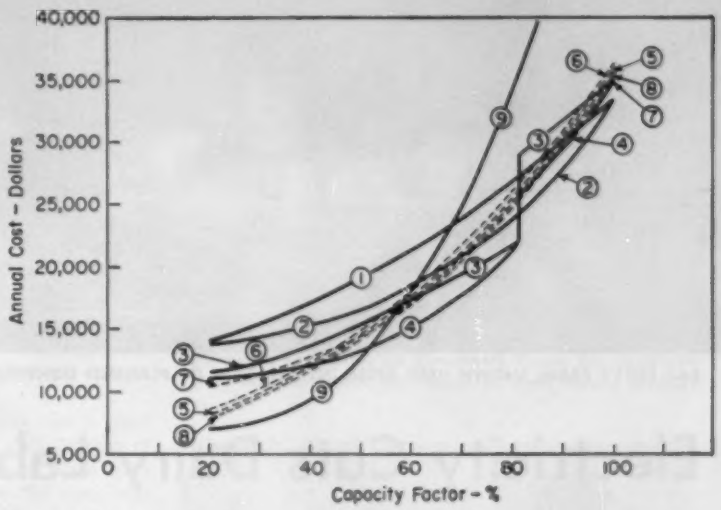
The modern hydraulic drive provides satisfactory control range and rate of response for boiler fan application and of the variable-speed drives presents the simplest means of speed control. This type of drive with conventional water-cooled hydraulic systems has been considered undesirable for outdoor locations in sub-zero temperatures because of the added costs of anti-freeze precautions. Fan locations at higher elevations in the plant also involve additional cooling water piping.

Electro-Magnetic Drive More Costly . . . The electro-magnetic drive with its more complicated control arrangement has a slightly higher annual cost than the hydraulic drive. It provides essentially stepless speed control with the highest rate of control response for increasing demand of any of the variable-speed drives. But it has no control over deceleration, and the inertia of the fan and its drive affect its rate of deceleration. Although the advantages of air cooling are present without external fans, heat dissipation to the surrounding air in indoor locations raises ambient temperature considerably. For higher ratings the construction frequently employs quill type shafts with internal bearings which present potential maintenance difficulties not inherent in other drive types.

Wound-rotor motor drives have the lowest annual cost of any variable-speed combinations. Of the two arrangements the step-type control has a slightly lower annual cost. This difference is so small, however, that the added complication of between-step and low-load damper control is not justified. Stepless control with the liquid rheostat is preferred.

A correlated rheostat and motor design provide satisfactory speed control to as low as approximately 20% speed. Its control system is somewhat less complicated than that of the magnetic drive. Rheostat system maintenance can be accomplished by switching to damper control, making fan shutdown unnecessary. The electrolyte and water cooling system must be weather protected for outdoor installation.

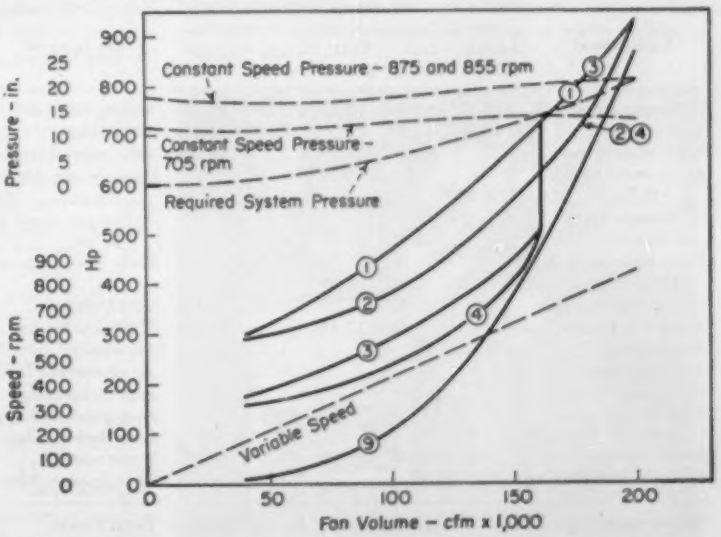
Fig. 4 – Annual Cost vs Capacity Factor for Induced Draft Fan Drives



1—Constant speed motor with damper
2—Constant speed motor with inlet vane, or louvre
3—Two (2) constant speed motors with damper
4—Two (2) constant speed motors with inlet vane, or louvre
5—Constant speed motor with hyldraulic variable speed drive
6—Constant speed motor with electro-magnetic variable speed drive
7—Wound rotor motor with step speed control and damper
8—Wound rotor motor with liquid rheostat control
9—Variable speed geared turbine with damper

While the relationship of the drives generally maintains the indicated pattern over the range of sizes encountered in the central station power plant, the merits of each individual case should be evaluated.

Fig. 5 – Operating Characteristics of Constant Speed Induced Draft Fan Drives



1—Hp input to constant speed motor with damper
2—Hp input to constant speed motor with inlet vane, or louvre
3—Hp input to two (2) constant speed motors with damper
4—Hp input to two (2) constant speed motors with inlet vane, or louvre

RAY LOTT'S FARM, SHOWN HERE AFTER INSTALLATION OF PLANNED LIGHTING, CAPITALIZES UPON ELECTRIC "LABOR"

Electricity Cuts Dairy Labor Costs

SALES
Rural

Electricity can do much of the work in caring for a dairy herd. One farmer's yearly power bill equaled a farm hand's monthly pay

ROBERT L. MADDEX, Extension Agricultural Engineer, Dept of Agricultural Engineering, Michigan State University, East Lansing, Mich.

The dairy farmer has the best opportunity to solve the hired hand problem, at least partially, by the use of electric power. It is estimated that about 80% of the work in caring for a dairy herd is in or around the buildings—within easy reach of electricity.

Records kept on several Michigan farms during the past three years show that electric power can replace the hired man as an economical and dependable source of labor. To get an exact picture of the work accomplished with electricity, meters were placed on the major appliances on several farms. These meters were read once each month for a year. The work accomplished during the month was recorded along with the meter reading.

Table I—Yearly Operating Costs, Dollars

Equipment	Farm				
	Marshke	Lott Year 1	Lott Year 2	Cook	Winters
Milking machine	$10.12	$9.36	$9.03	$11.25	$7.76
Milk coolers	45.60	60.38	65.50		45.88
Ventilation system		22.80	20.38		11.86
Dairy water heater (12-gal)	53.84			28.26	53.26
(Pressure-type, 30-gal)		18.72	18.72		
Farm shop (tools & lights)	0.76	1.30	2.59		
Gutter cleaner		2.52	2.70	0.86	1.64
Milkhouse heating		21.35	17.34		14.22
Arc welder				1.12	
Air compressor				0.22	
Feed mixer (3-hp)				0.84	
Feed grinder (3-hp)				*2.66	
Corn sheller (5-hp)				1.14	
Water system	9.40	5.33	6.08	15.58	17.62
Silo unloader (3-hp)				**3.26	
Total costs	$119.72	$141.76	$142.34	$65.19	$152.24

*Five months only.
**Three months only.

Table II—Yearly Power Consumption, Kwhr

Equipment	Farm				
	Marshke	Lott Year 1	Lott Year 2	Cook	Winters
Milking machine	506	416	401	603	388
Milk coolers	2,280	2,489	2,727		2,294
Ventilation system		829	741		593
Dairy water heater (12-gal)	2,692			1,440	2,663
(Pressure-type, 30-gal)		Flat Rate	Flat Rate		
Farm shop (tools & lights)	38	47	94		
Gutter cleaner		112	120	46	83
Milkhouse heating		949	771		710
Arc welder				60	
Air compressor				12	
Feed mixer (3-hp)				45	
Feed grinder (3-hp)				*143	
Corn sheller (5-hp)				61	
Water system	470	237	388	779	881
Silo unloader (3-hp)				**175	
Total Power	5,986	5,079	5,242	3,364	7,612

*Five months only.
**Three months only.

Each of the farms described in this article have more electrical equipment than is found on most dairy farms. These farmers, however, are netting a good income from their efforts, and at the same time they are doing the work with a minimum of physical effort.

The Cook family in Calhoun County farms 300 acres, with the primary enterprise being a dairy herd averaging 23 cows. The Cooks also feed about 180 hogs a year and keep a small flock of chickens. Thirteen motors, totaling 19 hp, are located in the farm buildings to reduce the man hours of labor required for the farming operations. In addition, there is a connected load of 10 kw for water heating, lighting, and welding.

The annual cost of electricity used in the farming enterprises on the Cook farm was $82.60. If a hired man were paid $1.00 an hour, the cost of electricity in the farming enterprises would equal about 10 days of work. Of course, many times it is impossible to hire a good hand, even at rates greater than $1.00 an hr.

For $82.60, the electrical "hired man" was able to grind 13½ tons of feed, mix 37 tons of feed, shell 20 tons of corn, dry 16 tons of hay, remove 61 tons of silage from the silo, remove 210 tons of manure from the barn, heat the water used in the milkhouse, ventilate the dairy barns, milk 135,476 lb of milk, and pump all the water used on the farm. The cost of operating the electrical equipment to do the work is shown in Table I. Kilowatt-hours used are shown in Table II.

An important work center on the Cook farm is the shop setup in one end of the machinery storage building. The electric arc welder has become a valuable piece of equipment because home repair of machinery saves precious time during planting and harvesting. Fabrication of such equipment as the gutter cleaner has saved much in investment as well as added labor-saving equipment to the farm.

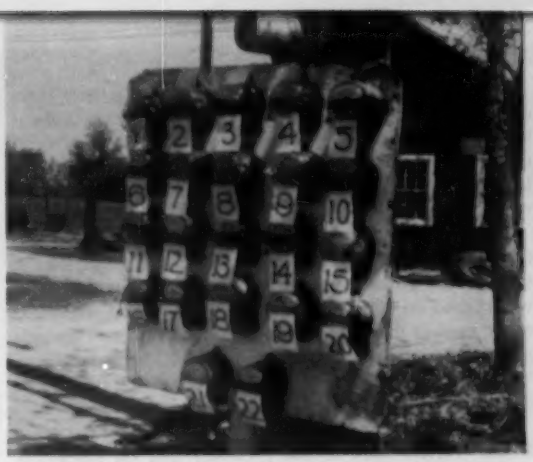
The electric motor serves well as an additional hired hand on the Ray Lott & Son farm in Ingham County. On this farm the electrical hand milks an average of 22 highly productive cows, cools 290,000 lb of milk from them, removes 300 tons of manure a year from the dairy stable, ventilates it and pumps 220,000 gal of water during the year to the farm buildings where livestock and poultry are housed. This work is accomplished at an annual cost of $99.87 for electricity.

Electricity also provides 30 gal of hot water a day in the milkhouse, warms the milkhouse during the winter through ceiling heating panels, provides through infrared lamps the heat needed to brood pigs, provides a stock tank de-icer with the energy needed to keep an outside tank ice-free, operates a corn sheller, provides light in farm buildings, runs the clippers and radio, and operates the welder and power tools in the farm shop at a cost of $102.96 a year.

It is pleasant to work in the Lott dairy stable during the winter because enough light is spotted in the right places to permit the worker to see easily. Low voltage relay units enable the workers to switch lights on and off from several places in the barn. Inexpensive switches connected to the relays by bell (small) wire make it possible to control separately the lights for each row of stanchions and the feed alley.

This multiple switching arrangement yields adequate light in all work areas yet helps to prevent excessive lighting costs. Switches are situated so the worker can turn lights on ahead of him and turn them out behind him.

(*Continued on next page*)



SUBMETERS PROVIDED by Consumers Power Co monitored power used on test farms. Readings were logged monthly

MILK IS COOLED electrically in this locker. The sub-meter on wall records power consumed by the spray pump on bench

ECONOMIC ARC WELDING on farm is an asset during planting and harvesting when machine breakdowns are menaces

The total cost of electricity for performing these tasks on the Lott farm amounts to $202.93 a year. This is about the wage of a hired man for one month. In addition to reducing the labor load of the farm, electricity enables the Lotts to market fluid milk with low bacteria count and to reduce the pig loss at time of farrowing.

The electrical equipment on the Lott farm was metered for 2 years. During one 12-month period, water meters were placed on the water lines. One meter measured the water used in the farm buildings. A second measured water used in the farm house. A total of 261,647 gal was pumped during this period at a cost of $5.33 for electricity. Water consumption in the farm buildings ran 220,014 gal, and 41,633 gal was used in the farm house.

Submeters were set on the electrical equipment on the Ethan Winters farm in Barry County and on the Frank Marshke farm in Berrien County. On the Winters farm electricity ran a milking machine, chilled milk in a mechanical cooler, ventilated the dairy barn, heated the milkhouse, heated water used in the milkhouse, and pumped all water used on the farm. Total cost for a year was $150.78. On the Marshke farm electricity powered the milking machine, cooled milk, heated water for the milkhouse, pumped water for the farm buildings, and provided power to the farm shop at a cost of $108 for a year.

Farm machines powered by electric motors operate at a low cost. Table III shows the cost of operating farm equipment on a unit basis.

"Labor" that will cool milk for less than 2¢ a can, take out the manure for a whole month for about ½¢ per cow, and milk the dairy cow for 3½¢ a month is available to the farmer only through use of electric power.

The cost of providing hot water in the milkhouse was substantially less on the Lott farm where a 30-gal pressure-type heater was used. Because this heater was controlled by a time clock, lower rates were charged by the electric power company. A similar rate was available to the other farms if the 30-gal pressure-type, two-element heater had been used. On farms using 12-gal heaters the cost per cow was slightly less than 1¢ a day. On the Lott farm the cost of hot water per dairy animal was ¼¢ a day.

Table III—Cost per Unit of Work

Farm	Appliance					
	Milk cooler per can		Gutter cleaner per cow per mo.		Milking mach. per cow per mo.	
	Kwhr	Cents	Kwhr	Cents	Kwhr	Cents
Marshke	0.6	1.2			1.9	3.8
Lott (Year 1)	0.68	1.7	0.22	0.56	1.52	3.8
Lott (Year 2)	0.72	1.8	0.24	0.6	1.40	3.4
Cook	1.1	2.0	0.24	0.42	2.5	4.6
Winters	1.0	2.0	0.23	0.46	0.9	1.8
Average:	0.82	1.7	0.23	0.51	1.64	3.5

Mixing feed, shelling corn, and throwing down silage are jobs requiring quite a lot of physical effort. On the Cook farm electricity was able to mix a ton of feed for 2.3¢, shell a ton of corn for 5.2¢, grind a ton of feed for 10¢, and throw down a ton of silage for 5.3¢.

The electrical equipment on these farms operated at high efficiency. The electrical wiring had not been neglected, and low voltage did not trouble these farmers. Proper wire sizes and enough feeder circuits to connect equipment as recommended made possible the safe and economical use of the electrical equipment.

GOOD LIGHTING IN THE DAIRY STABLE HELPS TO SPEED CHORES AND MAKE WORKING IN THE BARN MORE PLEASANT

Direct Burial Cuts Control Cable Cost

Installing wires in trench saves on conduit, space, labor for Kansas City Power & Light

I. G. **CHRONISTER**, Engineer, Kansas City Power & Light Co, Kansas City, Mo.

Direct burial of control cables has helped Kansas City Power & Light Co to keep substation control scheme costs in line. This practice economizes on space at a time when control cable space requirements are multiplying.

Direct burial of control cables eliminates conduits, resulting in the saving of conduit outlays. Easy installment and the method's flexibility cut labor costs. These savings are directly proportional to the control wire mileage.

The possibilities of directly burying control cable were investigated by Kansas City P&L when it first became evident that substation control wiring costs were verging on the prohibitive. This project sent the company to the cable manufacturers who conducted the necessary experiments, using actual utility field data.

Problems Solved . . . Buried cable sometimes was damaged by heavy equipment pressing jagged rocks against it or by a shovel in the hands of a vigorous digger. It was found that cable could be protected against such damage by placing it in a sand cushion with a treated plank over the sand. The back-fill had to be free of rocks.

Synthetic insulation on buried control wires was subject to break-down as a result of electro-endosmosis. Where such breakdown was complete, these conditions were common:

1. Conductors were single wires with 3/64-in. polyvinylchloride jacket.

2. Conductors were used for 125 v dc.

3. Conductors carrying negative dc were much more deteriorated than those carrying positive dc or ac.

4. Control wires were close to the station ground bus.

5. Faulted conductors were not in a trench like that shown in Fig 1. As a result of these findings, the use of single conductor was discontinued. The standard is now 4, 7, or 14-conductor cable with a 4/64-in. polyvinylchloride sheath over all. A two-conductor cable with similar insulation is used for station flood lighting circuits. Where a cable trench intersects a station ground bus, the ground bus is now lowered so that it is at all points a foot or farther from the control cable trench.

Joint Use of Trench . . . In an unusual instance where it is desirable to bury a high-voltage cable in the same trench with control cables, precautions must be taken to isolate the power cable. Concrete blocks accomplish this.

To date, Kansas City P&L buried control cables have shown no deterioration from microbial attack although other companies have reported such trouble.

FIG. 1—Cable trench cross-section

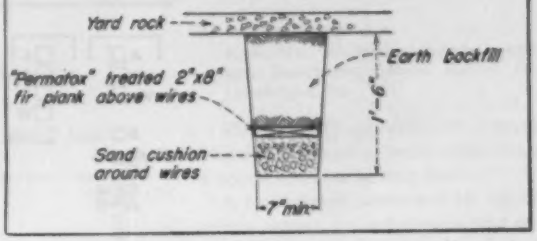


FIG. 2A—Cables enter house in ducts

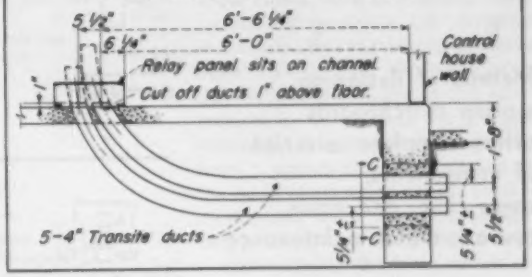


FIG. 2B—Duct cross-section

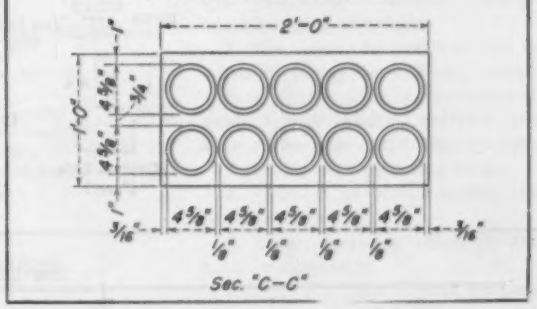


FIG. 3—Clearance reduces electro-endosmosis

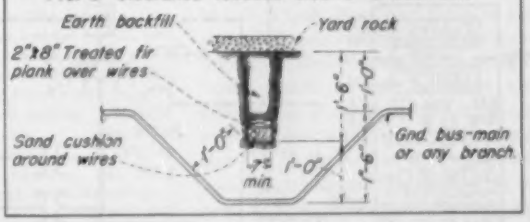
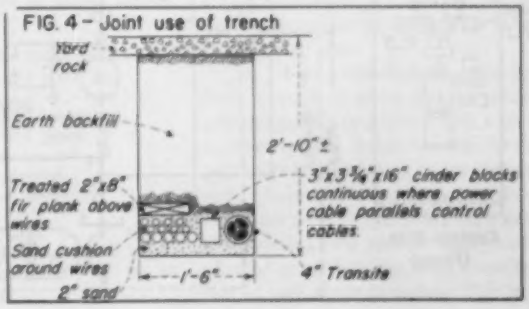
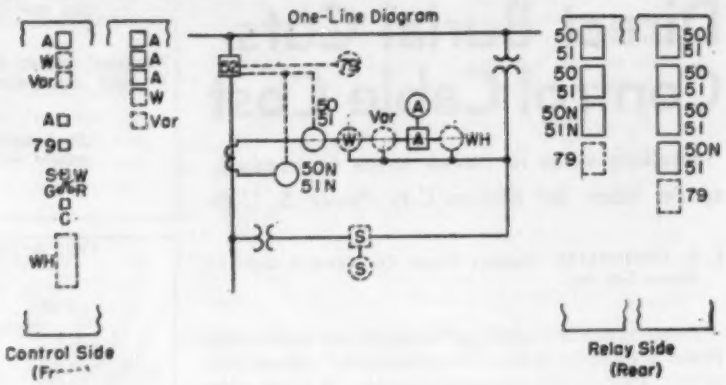


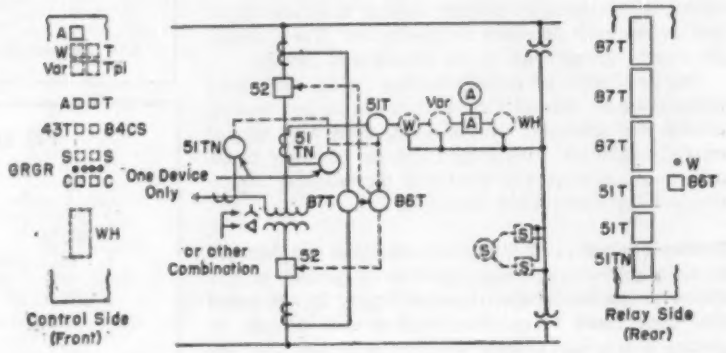
FIG. 4—Joint use of trench

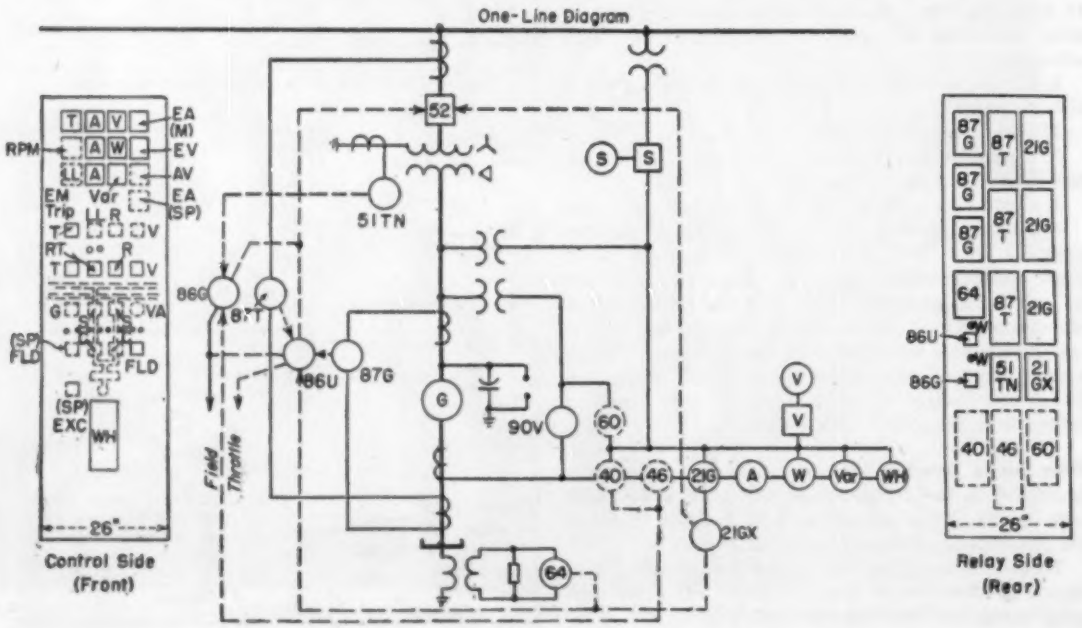


New Basic Circuit Approach Betters

Method of designing station switchboards offers complete selection of components, saves time, and eases operation and maintenance







Control Board Design

GENERATION & SUBSTATION
Design

A. W. BATEMAN and
K. R. WALCH, Medium Voltage Switchgear Department, General Electric Co, Philadelphia, Pa.

The correct approach to control board design is on a circuit rather than a complete panel or unit basis.

A basic circuit consists of all instruments, meters, control devices, and relays selected to control and protect a single circuit, such as a feeder, transformer, or generator. A complete switchboard unit is made up of one or more basic circuits, depending upon the width of panel desired and space required by the basic circuit arrangements. By designing on a basic circuit basis, a custom designed switchboard can be obtained which has the flexibility required for a particular installation.

Advantages of the basic circuit approach for a user are these:

1. More complete selection of system components without specific manufacturer's drawings.

2. The useful information that is available during the planning period, such as definite floor space allocation, more definite conduit locations, and known floor preparation requirements.

3. Savings in engineering time.

4. A design of proved quality and performance.

5. Better operating efficiency and easier maintenance.

Design of a control board by basic circuit approach is free from annoying repetitive details usually encountered in such a task. Personnel involved can devote all their capabilities to the more important undertaking of planning a board which is both adequate and economical. Unlimited choice of circuit location on the board and permissive use of optional devices make the basic circuit method applicable to almost any power system. The board is a quality product and has all the inherent advantages of being built along standardized lines.

The above observations emerged from a study of many power stations and substations conducted with a view to arriving at a design suitable to the particular needs of most power systems and producing a superior product. From the days of the lattice-type control boards to the present highly complicated ones, there has been a marked lack of uniformity in design. This lack

Fig. 1—Feeder Circuit Equipment with Overcurrent Protection

Basic Devices

1—Ammeter, indicating
1—Switch, 3 phase ammeter transfer
1—Switch, circuit breaker control, with red and green indicating lamps
2—Relays, instantaneous and time overcurrent No. 50/51
1—Relay, instantaneous and time overcurrent No. 50/51N

Optional additions

2—Ammeters, indicating, and omit ammeter transfer switch
1—Wattmeter, 3 phase indicating
1—Varmeter, 3 phase indicating
1—Watthour meter, 2 element
1—Switch, synchronizing
1—Lamp, white indicating (disagreement)
1—Mimic bus, painted
1—Relay, instantaneous and time overcurrent No. 50/51
1—Relay, automatic reclosing, 3 adjustable reclosures No. 79
1—Switch, reclosing, relay cutout No. 79CO

Fig. 2—Power Transformer Circuit Equipment

Basic Devices

1—Ammeter, indicating
1—Switch, 3 phase ammeter transfer
1—Switch, circuit breaker control, with red and green indicating lamps
2—Relays, time overcurrent No. 51T
1—Relay, time overcurrent No. 51TN
1—Relay, lockout, with white indicating lamps No. 86T
3—Relays, differential No. 87T

Optional additions

2—Ammeters, indicating, and omit ammeter transfer switch
1—Wattmeter, 3 phase indicating
1—Varmeter, 3 phase indicating
1—Watthour meter, 2 element
1—Temperature meter, indicating
1—Switch, temperature meter transfer
1—Switch, synchronizing
1—Switch, circuit breaker control, with red and green indicating lamps
1—Lamp, white indicating, (disagreement)
1—Mimic bus, painted
1—Drill, assemble and wire, for tap position indicator
1—Switch, tap position control No. 84CS
1—Switch, auto-manual transfer, for tap changer control No. 43T
1—Change, for 3-widning transformer, relays No. 87T to 3 winding

Fig. 3—Unit Generator and Transformer Circuit Equipment

Basic Devices

3—Ammeters, indicating
1—Voltmeter, indicating
1—Wattmeter, 3 phase indicating
1—Varmeter, 3 phase indicating
1—Temperature meter, indicating
1—Watthour meter, 2 element
1—Ammeter, d.c. indicating and shunt
1—Voltmeter, d.c. indicating
1—Switch, 3 phase voltmeter transfer
1—Switch, synchronizing
1—Switch, governor motor control
1—Switch, field rheostat control
1—Switch, regulator transfer, with red and green indicating lamps
2—Switches, temperature meter transfer
1—Switch, field circuit breaker control, with red and green indicating lamps
1—Switch, power circuit breaker control, with red and green indicating lamps
3—Relays, generator differential No. 87G
3—Relays, transformer differential No. 87T
3—Relays, external fault back-up No. 21G
1—Relay, auxiliary timing No. 21GX
1—Relay, generator ground No. 64
1—Relay, transformer ground No. 51TN
2—Relays, lock-out, with white indicating lamps No. 86G, 86U
1—Mounting and wiring for voltage adjuster

Optional additions

1—Voltmeter, d.c. indicating, for rotating type regulator
1—Ammeter, d.c. indicating, spare exciter, and shunt
1—Speed indicator
1—Load limit indicator
1—Switch, main-spare exciter voltmeter transfer
1—Switch, spare exciter field rheostat control
1—Switch, spare exciter starter, with red and green indicating lamps
1—Switch, synchronizing
1—Lamp, white indicating (disagreement)
1—Switch, spare exciter field circuit breaker control, with red and green indicating lamps
1—Switch, power circuit breaker control, with red and green indicating lamps
1—Switch, load limit control
1—Push-button station, generator emergency trip
1—Relay, loss of excitation No. 40
1—Relay, negative phase sequence No. 46
1—Relay, voltage balance No. 60
1—Mimic bus, painted

of conformity grew from the fact that many persons have their own approaches and preferences with regard to devices, device grouping, and structural configuration. It has long been recognized as not in keeping with modern engineering and manufacturing practices.

From the many control boards examined, information was collected on the following: Kinds of circuits, type and quantity of devices, physical patterns of the devices, and structural details. Also the following basic circuits were developed:

1. Ac feeder with overcurrent protection.
2. Ac feeder with directional overcurrent protection.
3. Power transformer.
4. Tie line with pilot wire relaying.
5. Transmission line with carrier directional distance protection.
6. Transmission line with directional distance protection.
7. Small ac generator.
8. Large ac generator.
9. Unit generator-transformer.
10. Bus differential protection.
11. Synchronizing.

Groups of Devices Selected . . . As a beginning, circuits most common in the industry, such as the circuits listed above, consisting of ac generators, power transformers, high-voltage lines, and feeders, were studied. Devices were selected on a basis of good engineering practice and most frequent use. For example, a simple feeder was listed as having the following:

1 Ammeter with transfer switch.

1 Circuit breaker control switch with two indicating lamps.

3 Overcurrent relays, time delay with instantaneous attachments.

These are the minimum devices required for any feeder of this type, but the following optional additions were also listed:

2 Ammeters (making a total of three, transfer switch omitted).

1 Indicating wattmeter.

1 Indicating varmeter.

1 Watthour meter.

1 Synchronizing switch.

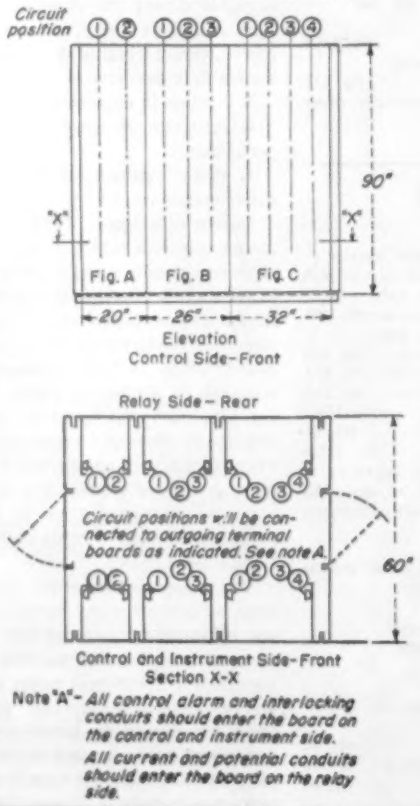
1 Overcurrent relay (making a total of four).

1 Automatic reclosing relay, multiple reclosure type.

These options are an essential part of the basic circuit method of designing because of the varying ways in which a circuit may be used. Lists of minimum devices and optional additions were made for different kinds of circuits.

Selecting a Structure . . . As a structure must be available for mounting any combination of circuit devices, its physical properties, such as overall size, floor anchoring details, and space for incoming cables, should be easily determinable. Among structures adapt-

Fig. 4. DUPLEX OUTLINE SHOWING THE THREE UNIT WIDTHS AND THE POSSIBLE CIRCUIT POSITIONS



Note "A"- All control alarm and interlocking conduits should enter the board on the control and instrument side.
All current and potential conduits should enter the board on the relay side.

Fig. 5. EXAMPLE OF COMPLETED ONE-LINE DIAGRAM SHOWING 34 KV PORTION OF A STATION

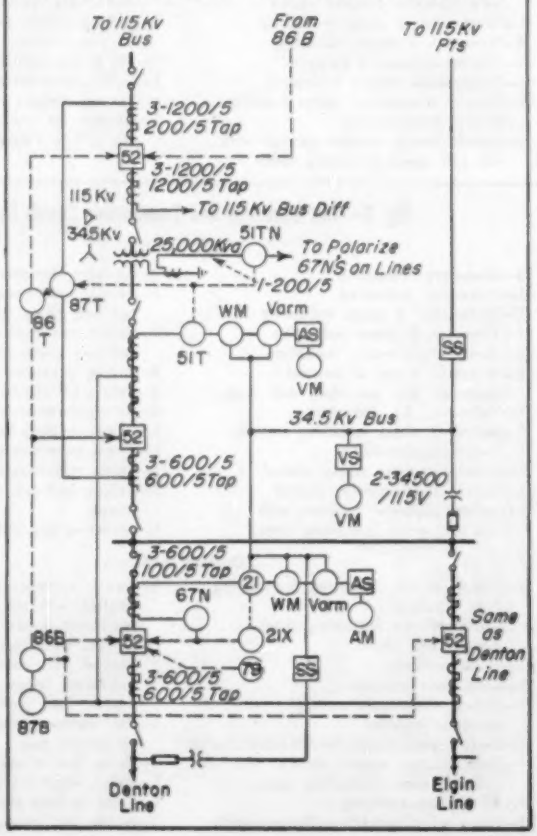
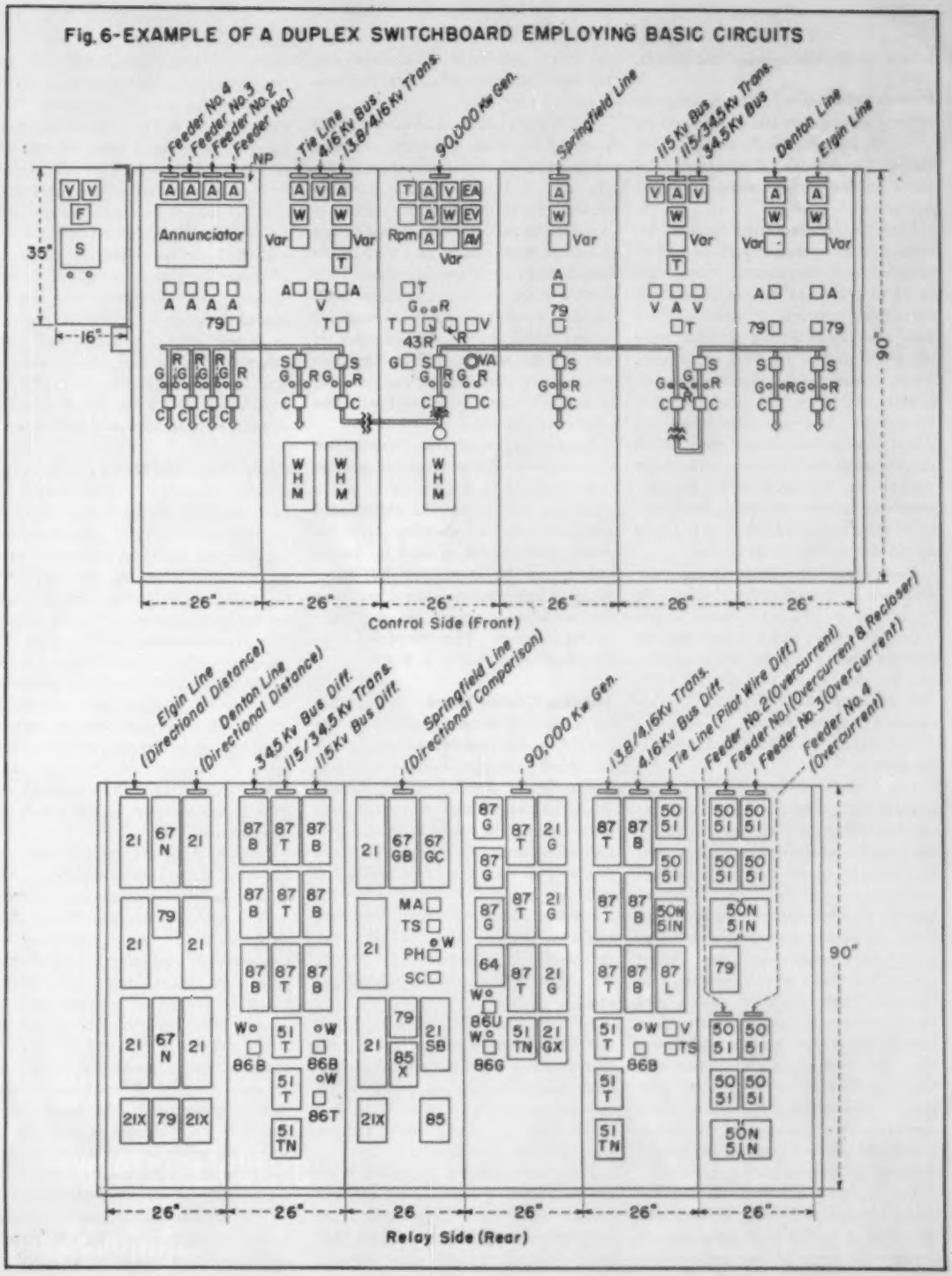


Fig. 6-EXAMPLE OF A DUPLEX SWITCHBOARD EMPLOYING BASIC CIRCUITS



able to the basic circuit method are duplex, dual, and vertical boards and benchboards.

The duplex switchboard is the only one considered here as it is in most use today. It consists of two or more panels placed back to back in a common structure and enclosed with a top and ends (not grille) having doors. Access space is provided between the rows of panels and for conductors between them. There are no primary

switching devices between the panels.

Pattern Selection . . . The pattern for placing devices on the control board must fit any group of circuits with any of the options included. All devices on all circuits were examined as a group.

First, devices requiring frequent attention of an operator, such as control switches and instruments, were allocated to the front or control side of the duplex structure. Protective relays and associated testing devices were relegated to the rear or relay side. Then, considering factors such as desirable operating locations, pleasing appearance, and versatility when optional devices were added, physical arrangement patterns for all circuits were worked out. A vertical device arrangement was adopted as lending itself best to all these considerations and to lining up the devices in circuit groups.

Components of a circuit group were arranged on the control and relay side of the duplex structure directly opposite each other. This group pattern permits placing any selected circuit in any location on the switchboard without affecting the overall device arrangement of the board.

For illustration, three basic circuits are shown.

Fig 1 shows a feeder circuit with overcurrent protection. The one-line diagram depicts operational features of the circuit, and the device arrangement the location of devices on front and rear panels of the duplex control board. Devices represented by solid lines are basic components, those by dotted lines optional additions. As an option, there is a choice between one ammeter with ammeter switch and three ammeters, and between three overcurrent relays and four. As shown, the circuit consists of one vertical column of devices on front and rear panels. Accordingly, the circuit occupies one circuit position on the duplex board and can be placed in any circuit position on front and rear panels.

Fig 2 shows a power transformer circuit. Basic and optional items are indicated as in Fig 1. But the devices occupy the space of two vertical columns, and therefore, two circuit positions are required on front and rear panels.

Fig 3 represents a unit generator-transformer circuit. The generator circuit is shown as a complete panel because it is undesirable to combine one or more other circuits with the generator control.

Fig 4 gives panel dimensions and the number of circuit positions available on each of three panel widths of 20, 26, and 32 in. which have been selected. These three panel widths accommodate two, three, and four circuit positions, respectively, and were established after careful consideration. They represent the absolute minimum panel widths based on nominal space for wiring. Also shown are locations of terminal boards for the outgoing control, current transformer, and potential transformer leads associated with the respective circuits.

In planning an electrical installation, desired power components are selected and arranged in the station to suit a particular condition. The abbreviated one-line diagram, showing only the power components of such an installation, can be completed by incorporating appropriate control and protective features shown on the basic circuit diagram. The completed one-line diagram is shown as Fig 5.

Building Control Board . . . To build up a control board, circuits are arranged in the required order, the order usually corresponding to the physical order of circuits in the station. Based on the number of circuit positions present, the board is divided into individual units. Several choices are available in the manner in which circuits are grouped. When five circuits are present requiring, respectively, one, two, two, one, one circuit positions, the unit widths in inches could be 20, 20, 20, 20 with one circuit position as spare.

Circuits could also be arranged on two 32-in. units with one spare position available for future use. On the other hand, the circuits could be accommodated equally as well on one 26-in. and two 20-in. units without space for the spare position.

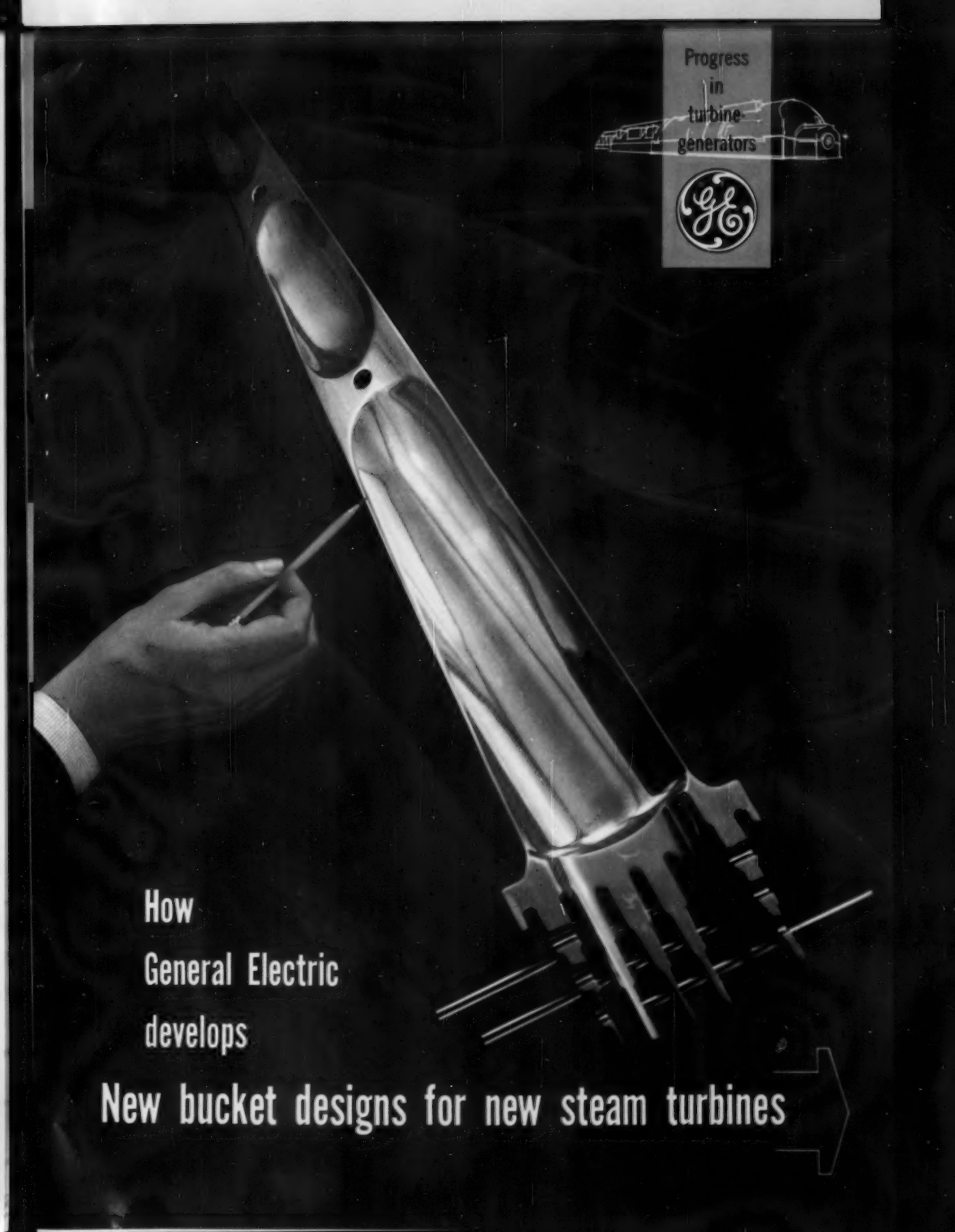
Fig 6 demonstrates use of the basic circuit method in constructing a typical control board for a large station. On both the control (above) and relay side (below) of the board, some circuits occupy complete panels; others only part of a panel and are thus combined. Relay components are mounted directly opposite instrument and control components. The bus voltmeters and bus differential relay protective equipment, not being associated with any one particular circuit, have been placed on panels at suitable locations. The duplex board in Fig 6 shows the feasibility of designing a board by sole use of the previously listed circuits. Other groups of components not listed may also be required. These groups may be for highly specialized applications with little or no respective usage, or they may be new applications. Motor circuits, although basic, were not included because it is normal practice to mount protective relays and most other devices on the primary switchgear. In any event, when circuits are present which are not listed, patterns already established would be followed.

Choice Narrowed Down . . . As in any scheme involving a combination of variables, this approach does not give an unlimited choice of component arrangements. Personal preference may seem limited when the governor control switch is designated for a position on the generator panel to the left of the synchronizing switch although there are other equally logical positions. Diminutive details of grouping instruments, switches, and relays are sometimes important only as matters of individual preference or inclination to a certain pattern. Actually, any device pattern skillfully contrived results in no sacrifice in operability or appearance.

Omitted from the basic circuits are two very important components, recording instruments and annunciators. It is a general recommendation that recorders not be mixed with other instrumentation and relays. They should be mounted on separate panels of the board or placed on another switchboard. When one recorder on each of a few circuits is required, it may be added to some unused space, such as the row allocated to watthour meters.

As a general rule, the annunciator should be on the front of the control board, the main control board usually being the most advantageous point for the operator. A recommended position for the annunciator is just below the indicating instruments on the panel, and its position should be included in the plan for allocating space for the circuits.

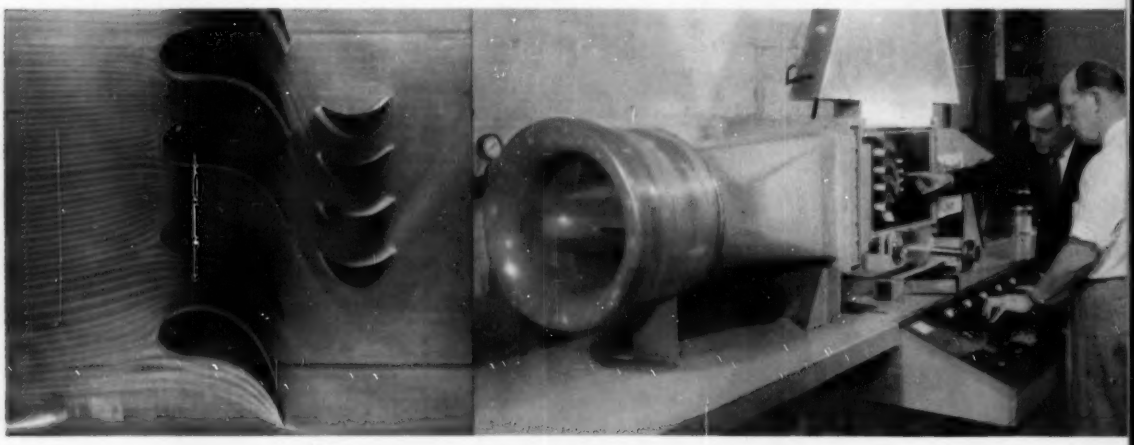
The basic circuit method is not restricted to the specific circuits listed. New repetitive circuits can be added, or revisions can be made as needed.


Progress
in
turbine
generators
How
General Electric
develops
New bucket designs for new steam turbines

Extensive development boosts

This General Electric 26-inch, 3600-rpm turbine bucket, with a nested pin-type dovetail, was engineered to meet a specific need arising out of a new turbine design. It typifies the success of G.E.'s intensive bucket research and development program. Every new steam turbine condition—higher pressure, higher temperature, greater capacity—involves a fresh bucket design problem. G.E.'s combined resources of metallurgy, aerodynamics and engineering experience are utilized to help solve these problems. These pages picture how it is done . . .

ELECTRONIC CALCULATOR. G-E engineers use digital computing machines to assist them in solving the complex stress, vibration, and thermodynamic problems that arise in the design of new buckets. With these machines design refinements otherwise impracticable can be made.



AERODYNAMICS. Smoke tunnel in G.E.'s Air Test Laboratory shows how steam will flow past proposed bucket and nozzle designs. Disturbances can be photographed for detailed analysis later. Other equipment in this laboratory includes a single-stage air turbine which determines static and impact pressure, air flow, and temperatures. Various kinds of instruments record the data obtained.

bucket strength, length, efficiency

METALLURGY. Special alloys for turbine buckets are studied in General Electric's Materials and Processes Laboratory. Optical metallograph shown above achieves magnifications ranging from 50 to 2000 diameters. With it, experts can judge a metal's structure to determine suitability for actual service.

PHYSICAL TESTING. Bucket materials slated for use in new G-E steam turbines must undergo evaluation in this laboratory. They are subjected to tests for tensile strength, elasticity, ductility, impact strength, hardness, etc. Special equipment can impose many tons of tension on various specimens tested.

VIBRATION TESTING. Buckets and wheels are designed with natural vibration frequencies such that actual operation will be in "quiet zones." By making sure that steam impact frequencies do not coincide with natural frequencies, a major cause of bucket failure is virtually eliminated. Above, vibration testing with special electronic equipment confirms calculated frequencies.

The Future

Progress Is Our Most Important Product

GENERAL ELECTRIC

Trend for the future—development of longer, more efficient last stage buckets

G-E engineers in the picture above are studying a test set-up on a unique research turbine in the new Turbine Product Development Laboratory in Schenectady. For the first time, it is possible to make full-scale evaluations of the performance of the low-pressure elements of large turbines duplicating actual power plant operating conditions. This appears to be one of today's most promising areas for improving over-all efficiency.

A major step already under way is the development of longer, last-stage turbine buckets. G.E. has developed and is using a giant, 43 inch bucket for 1800—rpm units. It will raise efficiency over previous bucket designs by 1.1%—and will save up to 12 million pounds of coal annually in the 207,000-KW unit for which it was originally developed.

Longer last stage buckets are but one aspect of the thorough utilization of last stage energy. A variety of nozzle and exhaust hood configurations are being developed. Much lies ahead in steam turbine development. For the complete story contact your nearest Apparatus Sales Office, or write Section 254-25, General Electric Company, Schenectady 5, New York.

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Tester Checks Transmission Splices

TRANSMISSION Operation

Comparing IR drop across a line splice to that for an equal length of conductor provides reliable results

A. S. RUNCIMAN and H. WESTMAN,
The Shawinigan Water & Power Co,
Montreal, Canada

An instrument has been developed by The Shawinigan Water & Power Co that checks the condition of compression splices on transmission conductors without taking the line out of service. It is used to measure the voltage drop across a splice and the drop across an equal length of conductor. By comparing the two readings a measure of joint reliability is obtained.

The instrument consists of a lightweight aluminum and plastic frame, brass pulleys, a small transformer, and an 0-100-microamp dc ammeter, with all parts bonded to prevent corona fuzzing. The ammeter's moving element is in series with a germanium diode and shunted with a resistance. By adjusting the resistance on the job the meter can be set to indicate at center scale the normal drop for each line current, thus adding flexibility.

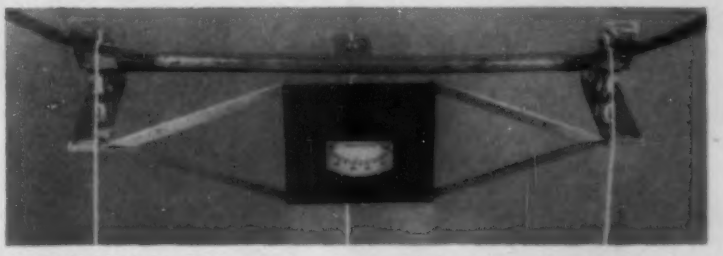
How To Use Voltage Tester

In operation, two nylon lines attached to the instrument are tossed over the conductor. Pulling on these lines raises the instrument and tips it into positon so that the brass pulleys having square step-cut surfaces ride on the conductor. Good contacts are obtained by rocking the sharp pulleys on the conductor until the meter reads steady.

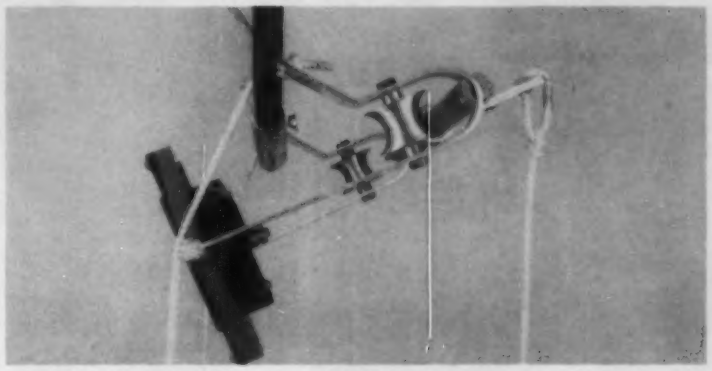
A reading is taken on the conductor and another across the splice. The joint reading divided by the cable reading gives a ratio that determines the condition of the joint.

Many tests made in the laboratory and the field indicate that the lowest possible ratio is 0.43. Most joints

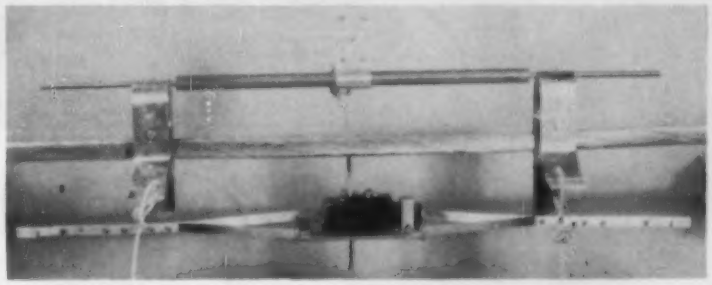
(*Continued on page* 97)



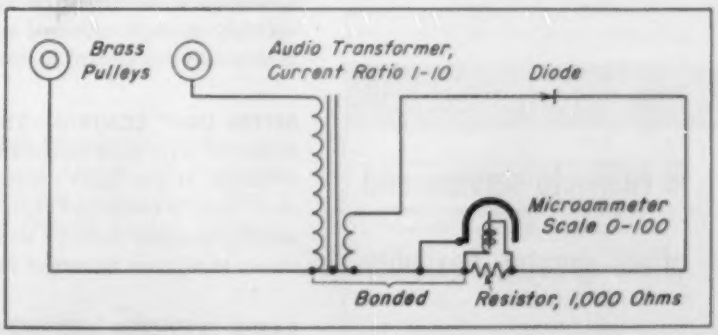
VOLTAGE-DROP TESTER is raised up to transmission wire with two ropes



FURTHER PULLING tips the instrument so that pulleys ride on conductor

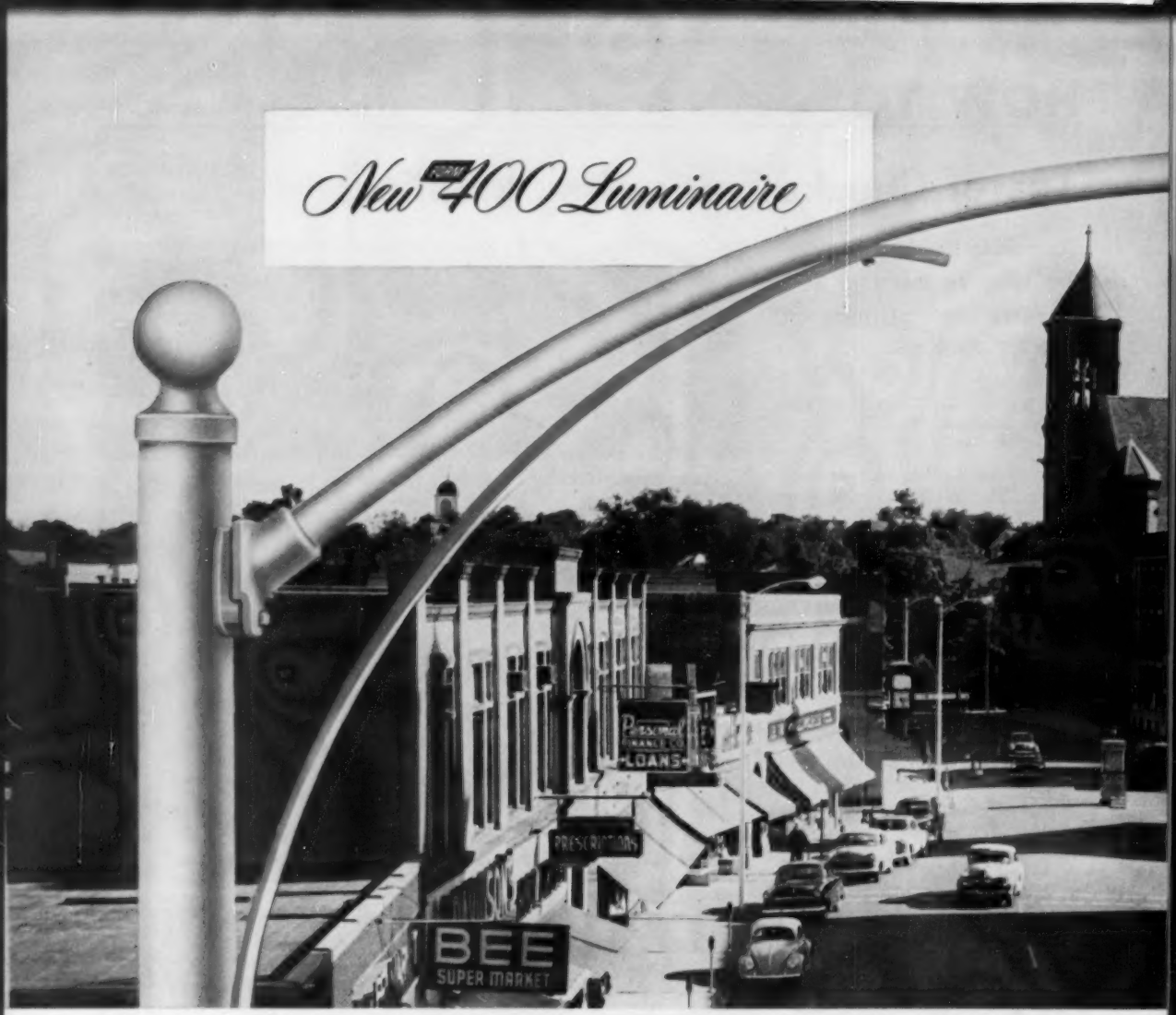


IN FINAL POSITION, meter measures drop across length of wire or joint



METER INDICATION can be increased for small IR drops by changing resistor

Adapted from a paper presented at the 1955 AIEE Winter General Meeting held in New York, N. Y.



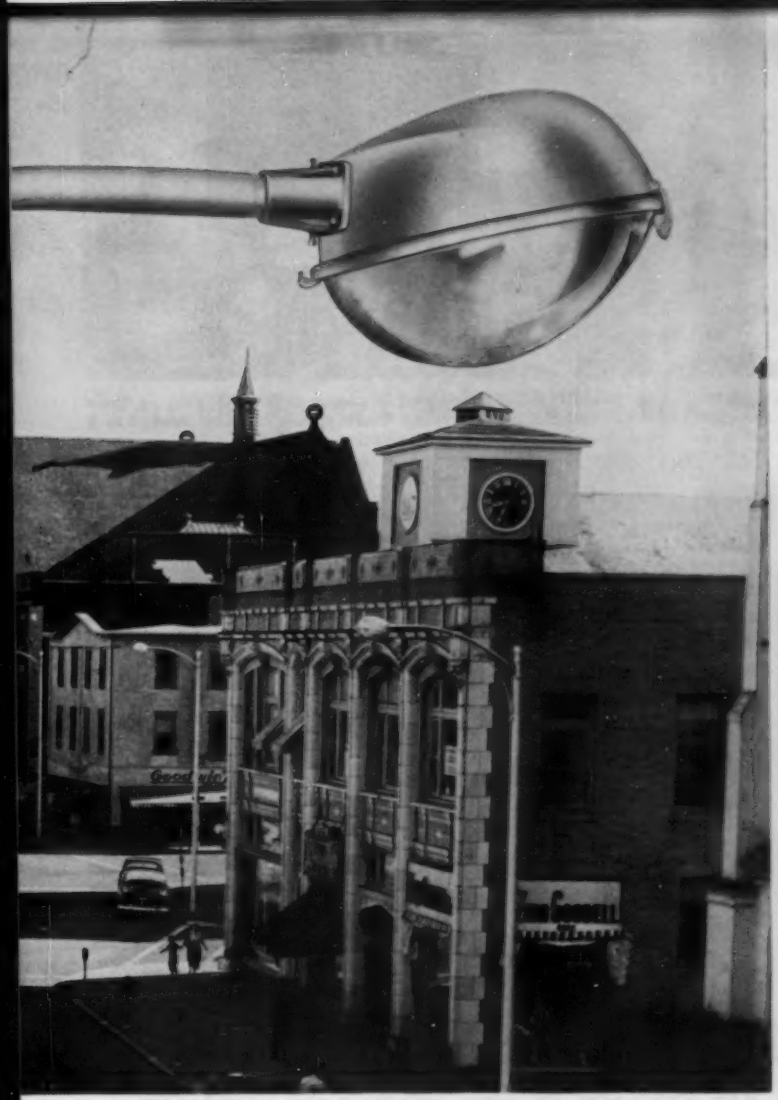
New G-E FORM 400 Luminaire Provides

New mercury street light is easier to service, and offers greater flexibility

The new General Electric Form 400 luminaire is an important advancement in mercury street lighting. Besides providing better over-all visibility through improved optical performance, the new Form 400 is unusually economical to install and maintain.

BETTER LIGHT CONTROL—The unique tilted optical system of the Form 400 puts more light on the street for a new high in utilization efficiency. It also lights the pavement more uniformly over its entire area. Glare is minimized through more effective shielding of the light source. No other mercury street light has ever achieved such superiority in all these factors of visibility.

EASIER SERVICING AND GREATER FLEXIBILITY make the new Form 400 exceptionally economical. The hinged glassware swings down to provide complete accessibility for relamping or cleaning. No tools are required to detach the glassware or reflector from the unit. Sepa-



Better Over-all Visibility

rate, snap-in reflectors provide a choice of either Type II or Type III distribution using the same glassware. Five different mercury lamps may be used, and you have a choice of either multiple sockets for conventional ballasted operation, or an entirely new series socket for Ballastless Mercury Systems.

MORE INFORMATION on this outstanding new development in mercury street lighting is available from your nearest G-E Apparatus Sales Office or Authorized Agent, or by sending in the coupon. Section 452-153, Outdoor Lighting Department, General Electric Company, West Lynn 3, Mass.

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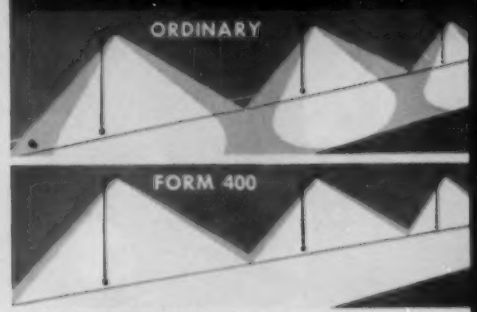
GENERAL ELECTRIC

BETTER LIGHT CONTROL



GREATER UNIFORMITY of pavement brightness and a new high in utilization efficiency are achieved by the new Form 400 luminaire.

NEW EASE OF SERVICE

HINGED GLASSWARE speeds up maintenance of the new Form 400. Both reflector and glassware can be detached without using tools.

GREATER FLEXIBILITY

FIVE DIFFERENT LAMPS, multiple or series sockets, and either Type II or Type III reflectors can be used in the new Form 400.

WRITE FOR FULL INFORMATION

Section D452-153, Outdoor Lighting Dept.
General Electric Co., West Lynn 3, Mass.

Please send me full information on the new Form 400 Mercury Luminaire

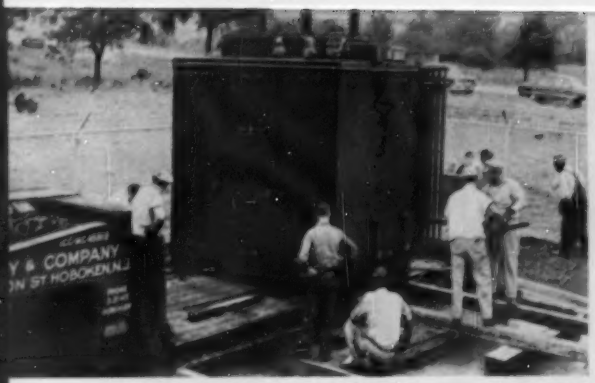
Name .....

Company .....

Street .....

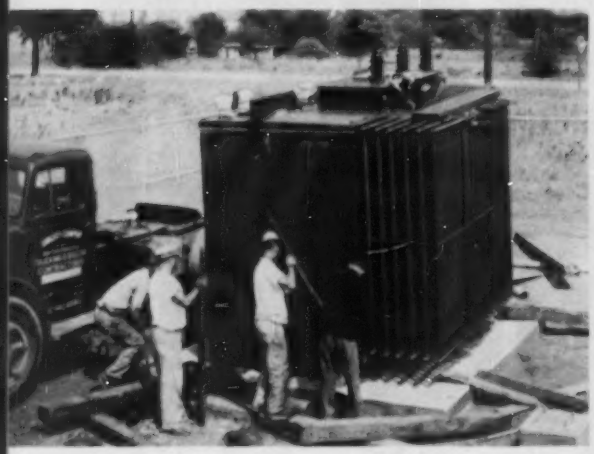
City ..... State .....

are required to detach the glassware or reflector from the unit. Sepa-

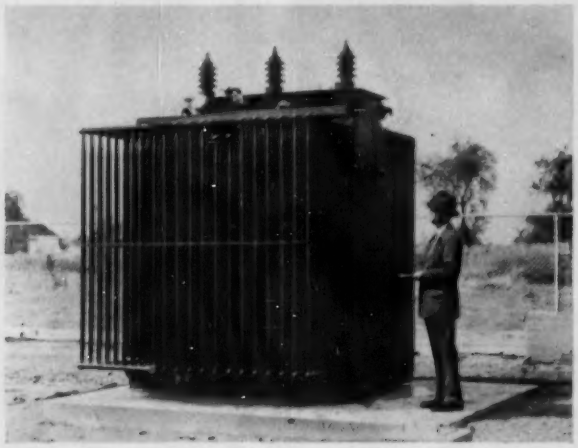


1. JACKING UP substation to move from trailer was the first installation step. Unit had already been trucked 18 miles when this operation started at 11:20 a.m.

2. QUARTER TURN gets unit in proper position for jacking down to foundation. Winch on truck makes turning substation a simple operation—speeds installation.



3. JACKING DOWN—the final step—was started early in the afternoon and completed by 3:20 p.m.



4. IN FINAL POSITION, ready for assembly of lightning arresters and erection of station steel.

Positions G-E unit substation in 4 hours

PUBLIC SERVICE ELECTRIC AND GAS COMPANY OF NEW JERSEY CUTS INSTALLATION MAN-HOUR COSTS WITH PRE-ASSEMBLED G-E SINGLE-CIRCUIT SUBSTATION

Pre-assembly at the General Electric factory allowed the Public Service Electric and Gas Company of Newark, New Jersey, to unload this G-E unit substation at the freight yard, transport and position it on its foundation, ready for connection, in a single day. Starting at 7:30 a.m., the unit was trucked 18 miles to the site and skidded onto its foundation by 3:20 in the afternoon. The installation operations of unloading, skidding and jacking down required only four hours.

HERE'S HOW YOU, TOO, CAN BENEFIT BY SPECIFYING G-E SINGLE-CIRCUIT UNIT SUBSTATIONS:

Easier installation: No field assembly is necessary. All components are co-ordinated and assembled at the factory. This drastically cuts installation time.

Low, predictable installed cost: You don't have any accessories or "extras" to buy with G-E packaged substations. Since installation consists merely of locating the unit on its foundation and connecting the leads, installation expense, which can be readily estimated in advance, is reduced to a minimum.

Simpler purchasing: There's only one specification—one transaction when you buy G-E single-circuit substations. And you get centralized responsibility, too, because all unit components are engineered and manufactured by General Electric.

For full details, contact your nearest G-E sales representative or write General Electric Company, Section 422-20, Schenectady 5, New York.

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Testing Line Splices

(*Continued from page* 93)

range between 0.6 and 0.9 Joints with a ratio of unity operate at a slightly lower temperature than the conductor, while those with a ratio of 1.5 operate at a higher temperature than the conductor.

Shawinigan W&P follows the practice of correcting joints having a ratio greater than 0.9.

Experience during the past three summers shows that the instrument is easily handled by field crews and provides reliable data on compression joints. It has also been used on twisted sleeve joints with welded ends and, in one case, indicated that one end had a high resistance because of a bad weld while the other end was good.

DISTRIBUTION—Construction

Fork Lift Erects Lighting Standards, Solves Traffic Problem

SETTING STREET-LIGHT STANDARDS with a hydraulic fork-lift truck eliminated need for a line truck with A-frame, which is more costly to operate

C. B. TALLEY, Charleston District Manager, Appalachian Electric Power Co, Charleston, W. Va.

A hydraulic fork-lift truck has been used by Appalachian Electric Power Co to set street light standards where a truck and A-frame could not be used because of on-the-street parking. The fork-lift truck was operated on the sidewalk to transport the standards from street intersections, where they were unloaded, to their locations. Here the hydraulic lift was used to erect the standards.

"Operation sidewalk" revealed that the fork-lift truck:

1. Is easily maneuvered into cramped spaces.
2. Eliminates blocking or hampering normal flow of street traffic.
3. Eliminates raising and lowering an A-frame when moving from one installation site to another.
4. Is easier to control than a winch.
5. Affords the driver a better view of operations.
6. Is more economical to operate.

SUBSTATION—Maintenance

Trailer Simplifies Scaffold Hauling

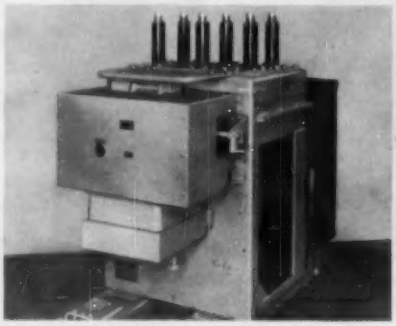
Hauling scaffolding was greatly simplified by building a metal rack on the bed of an unused trailer. The rack was covered with sheet metal, for protection; and compartments were built from each section of scaffold. This permits storing scaffolds on the trailer. Charles L. Keller, Superintendent Underground Dept, Toledo Edison Co, Toledo, Ohio.

(*More How To on page* 104)

Add it all up . . .

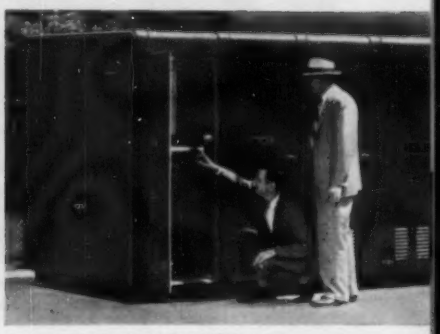
CLEAN COMPACT G-E UNIT SUBSTATIONS . . . metal-clad switchgear connected to 3 phase transformer by streamlined transition compartment . . . presents attractive appearance, requires little installation space.

METAL-CLAD SWITCHGEAR with advanced-design weatherproof construction. All-welded steel frame stands cross-country shipping jolts. Factory pre-assembly simplifies installation.

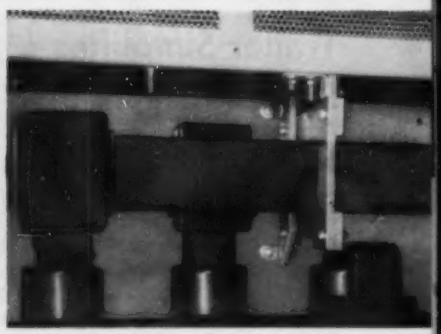


MAGNE-BLAST BREAKERS have 5-cycle clearing time, highly-repetitive-duty performance, close and latch against full momentary rating, built-in "capacitor-switching" ability.

SELF-X FLAME RETARDANT INSULATION, backed by four years of field experience, provides greater protection at all vital points in breakers and switchgear compartment.



SWITCHGEAR MAINTENANCE is fast and easy. Magne-blast breakers require ⅓ as much maintenance as similar oil breakers. All components are easily accessible.



TOTALLY ENCLOSED INSULATED BUS is practically impregnable. Since it is not exposed at any point, it requires almost no maintenance, provides greater reliability.

. . . . HERE'S WHY IT PAYS TO BUY A G-E UNIT SUBSTATION

The high-quality features built into General Electric Unit Substations add up to important long-range savings. These reliable, compact units are faster to install, require less space, are easier to maintain and help you provide more reliable service for your customers.

Some of the cost-saving features of this equipment are illustrated on these pages. For the complete story, contact your G-E Apparatus Sales Office, or write for bulletin GEA-3800. Section 512-6, General Electric Company, Schenectady 5, New York.

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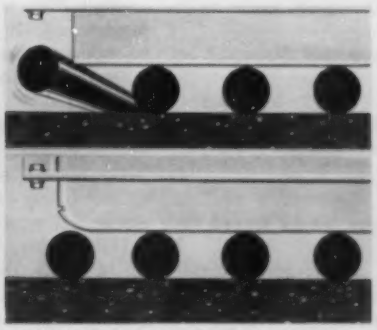
COMPACT 3-PHASE TRANSFORMER has only ½ as many bushings as three single-phase transformers, requires less maintenance. *American Standard Bushings* reduce inventories.

LOAD TAP CHANGING EQUIPMENT provides voltage regulation. Large hinged door, providing easy access to operating mechanism, simplifies maintenance.

FORMEX® WIRE WINDINGS reduce size and weight, increase reliability. This tough, pliable film insulation, which is an integral part of the wire, has amazing dielectric strength.

FLOOR-LEVEL DRAIN allows more complete filtration. In addition, it permits sampling of poorest oil to give better check on conditions inside the tank.



SKI-TIP BASE for easier transformer installation. Ordinary base (top) has sharp corners, is difficult to skid. Ski-tip (bottom) rolls smoothly and simplifies installation.

AND YOU GET THESE "EXTRAS" WHEN YOU SPECIFY GENERAL ELECTRIC

- **One year warranty on *entire equipment.***
- **Installation inspection service.**
- **"Match-and-line-up" service that provides additional matching feeders long after original installation.**
- **Good appearance that promotes community goodwill.**

®Reg. trademark of General Electric Co.

Safety Rules for Industrial Plants

INDUSTRIAL Operation

A set of Do and Don't rules relate to safety in operation and maintenance of electrical equipment in any industrial plant

WALTER J. PRISE, Chief Engineer, Queens Electric Motor Co, Jamaica, N. Y.

What to DO

Do preach and practice safety at all times. Good work can be spoiled by an accident.

Do work deliberately and carefully. Haste causes many accidents. BE SURE OF WHAT YOU ARE DOING.

Do place sign "Men Working" on main switch before commencing work.

Do consider all apparatus "alive" until you are positive they are "dead."

Do cultivate the habit of turning your face away whenever an arc or flash may occur, as when closing switches or circuit breakers.

Do guard against arcs as well as high voltage. Remember that burns from arcs may be very severe.

Do be careful to keep watch chains, finger rings, and metallic pencils out of contact with "live" parts when around electrical equipment. Watches may be made inoperative by magnetic effect of electrical rotating machinery.

Do see that all splices and connections are securely made.

Do use extreme care when breaking an inductive circuit as dangerously high voltage is likely to result. Particular attention should be paid to the inductive discharge of field circuit.

Do test rubber gloves periodically.

Do avoid the capacitance effects of transformers and other high-voltage apparatus. In this type of apparatus the frame of the machine acts as one side of a capacitor, and the coils or windings as the other side; hence anyone making contact with the two sides will receive through the body the discharge which, in some cases, is highly dangerous.

Do place guards around belts.

Do be sure apparatus is clear of loose parts, etc, and that nobody is left working on a machine before it is energized.

Do inform foreman in charge that you intend to put electrical machinery in operation.

Do place rubber mats in front of electrical switchboards.

Do keep inflammable material only in special containers and in fireproof rooms.

Do prevent accumulation of gases in unventilated rooms. Varnishes emit inflammable vapor.

Do be sure that your men are familiar with the location of fire fighting apparatus.

Do organize precautionary fire drill.

Do have sufficient number of fire extinguishers located in strategic positions, so that they may be available for immediate use in various areas. Check fire fighting apparatus periodically.

Do wipe up oil as soon as possible; use sand to cover oil spots.

What NOT to DO

Don't close or open a switch slowly or hesitatingly; but do it quickly and positively.

Don't turn your face and then grope for the switch or circuit breaker.

Don't open "live" power circuits with knife switches.

Don't place any part of your body in circuit either to ground or across the terminal when making a connection or operating.

Don't use bare fingers or hand to determine whether a circuit is "alive." Low voltage must not be treated indifferently.

Don't expose your eyes to an electric arc. Painful injury may result even with very short exposure.

Don't use wires with poor insulation.

Don't use a metallic or metal-bound measuring tape near "live" circuits.

Don't lift brushes from commutator or slip rings while the machines are in operation.

Don't open secondary of current transformer while it is energized. If opened, a dangerously high voltage will be induced across the secondary terminals.

Don't use a metal-case flashlight around apparatus which is energized.

Don't touch an electric circuit when your hands are wet, or bleeding from a cut or an abrasion.

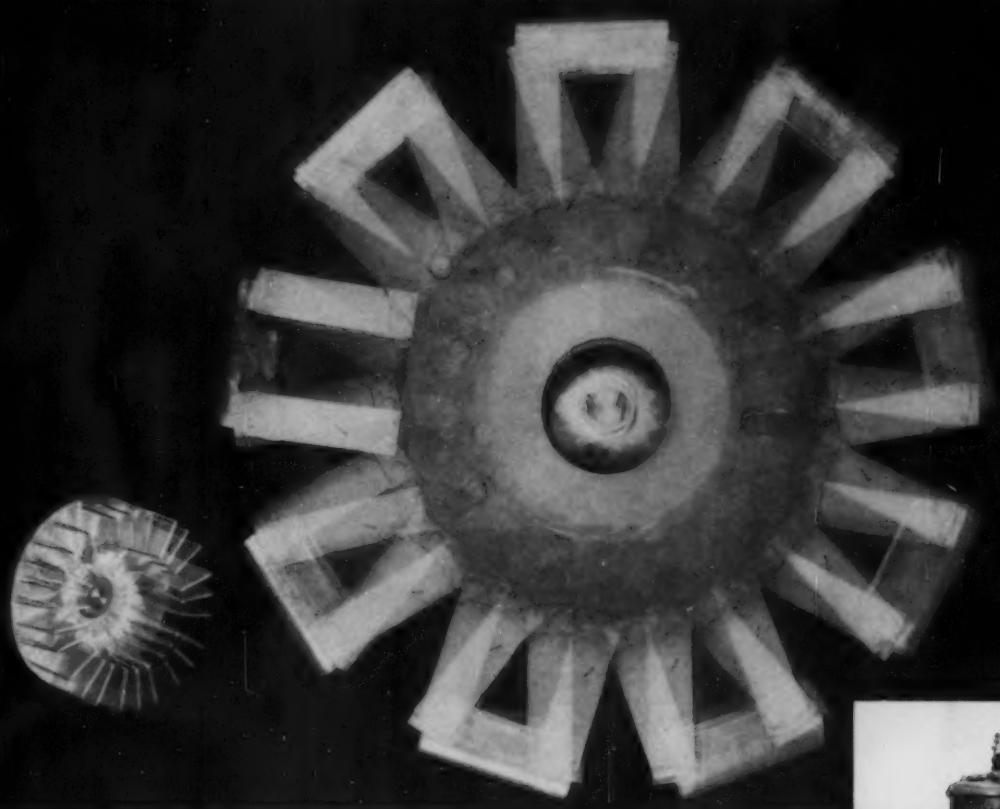
Don't work on energized circuits higher than 230 v without taking extra precautions such as the use of rubber gloves and wooden handles.

Don't break burned out fluorescent tubes with bare hands. Don't overlook use of a mechanical tube breaking device thus avoiding cuts and possible infection.

Don't stand on, sit on, or pass through belts whether in motion or at rest. Keep out of line and plane of rotation when possible.

Don't use toxic solvents in poorly ventilated rooms.

Don't use saw dust in a shop.



STROBOSCOPIC PHOTO of spinning paddle wheel (left) and rotating tap changer on G-E ML32 regulator.

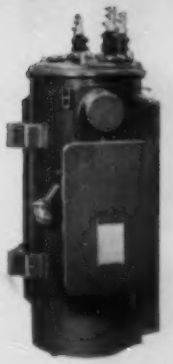
DOES YOUR SUPPLEMENTARY REGULATOR HAVE

"Bounce-free" switch action for lower maintenance cost

Here's *another* important General Electric voltage regulator feature that appreciably lengthens contact life—reduces maintenance expense. The secret: "Bounce-free" Opti-Life switching, which makes the contacts glide into the next tap position.

See that little paddle wheel in the photo, at the left of the switch? It acts as a speed-controller to minimize erosion as the contacts part. You get an optimum speed . . . not too fast, not too slow. Also, entry into the next position is smooth, positive, with no life-reducing bounce. This little Opti-Life impeller has helped extend contact life to over *five times what it was ten years ago!* It's an exclusive feature of G.E.'s ML32 single-phase step voltage regulator for supplementary service.

12 more features, many just introduced into the 1955 ML32 feeder voltage regulators, mean greater accuracy, longer life, superior service. They add up to the most advanced supplementary regulator available today. General Electric Company, Schenectady 5, New York. 413-6



ONLY THE ML32 GIVES YOU ALL THESE FEATURES

Greater Accuracy

Class 1 Control Accuracy
Control Dial Locking
Control Test Rheostat
Rheostats For LDC Adjustments

Longer Life

Opti-Life Tap Switching
One-Piece Cover Band
Super Melaglyp Paint
Nitrile Rubber Gaskets
Electrostatic Shielding

Superior Service

Flat Upper VRR Contacts
Up To 120-Sec. Time Delay
Handy Meter Shelf
Internal By-Pass Protection

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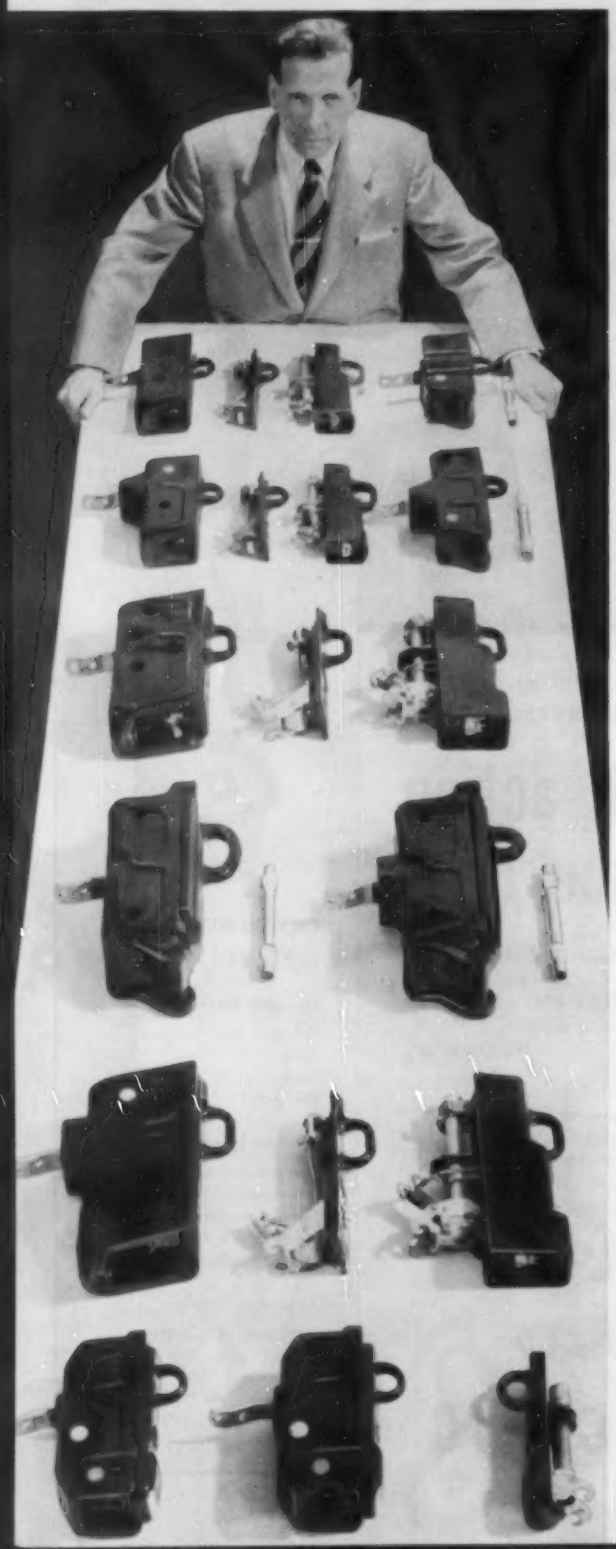
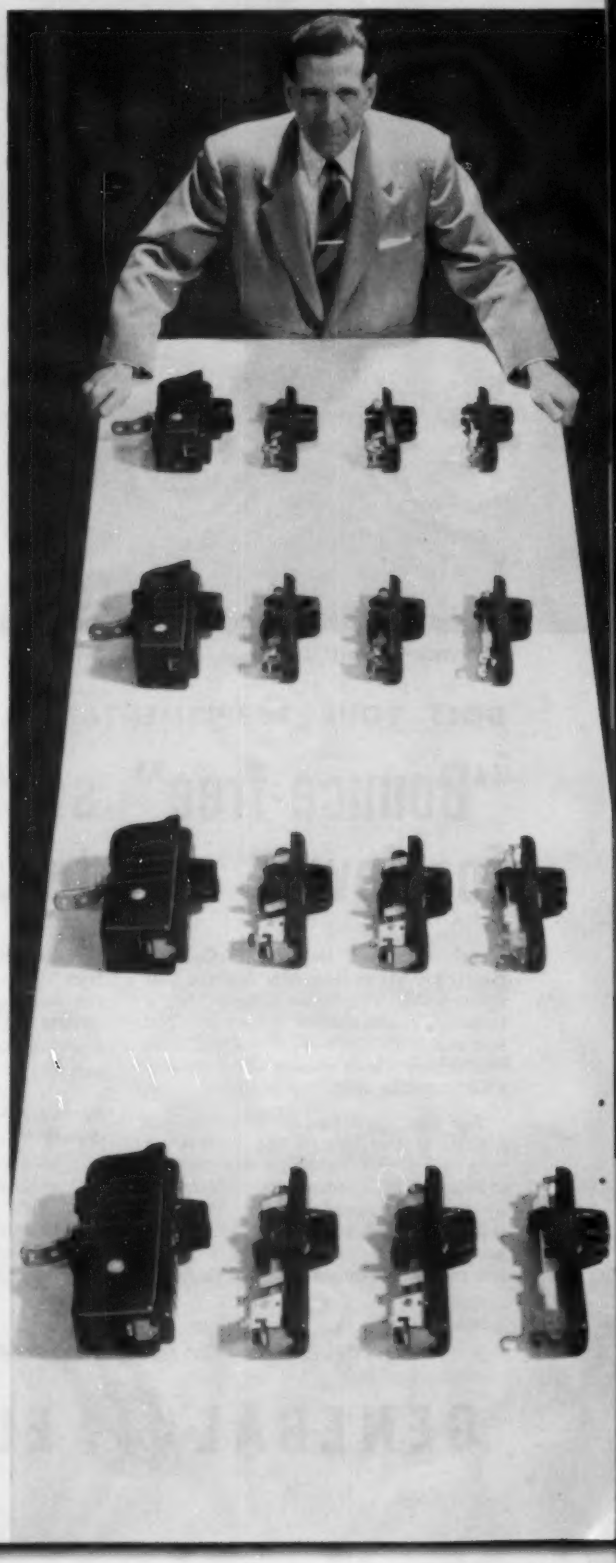
old

Stan Howard, Supervisor, Product Engineering, displays 10 housings and 15 doors of old cutout design.



new

In new design, Stan shows total reduction in housings and doors while interrupting ratings are increased.



ALL-NEW ENCLOSED FUSE CUTOUTS

now...

Stocking is simplified, interrupting ratings increased in new G-E fuse cutout line

Not since 1935, when General Electric first introduced the "family" concept of interchangeable doors, has there been an enclosed fuse cutout development like this!

ALL THE FUNCTIONS—with fewer housings. Before, it took ten housings and fifteen doors to do the job. Now, in G.E.'s all-new line, *four housings and sixteen doors meet every standard cutout need!*

Think of what this means to you and your lineman: There's less chance of error. Stocking is simplified, too. Smaller inventories mean lower handling and storage costs—and lower installation costs. All the lineman has to do is change doors to uprate the cutout.

EVERYTHING YOUR SYSTEM NEEDS. G.E.'s new fuse cutout line gives you all functions—drop-out, non-dropout, indicating, disconnect—in one basic design. You get normal-duty, heavy-duty and/or extra-heavy-duty in all ratings, to match every possible system demand. For a complete description of the new cutout line, write for Bulletin GEA-6208, General Electric Company, Section 433-9, Schenectady 5, N. Y.

LINEMEN AND ENGINEERS AGREE
The completely new line of G-E fuse cutouts has more of the features they prefer. There's good reason, too—the new design incorporates suggestions made by utility engineers and linemen to G-E sales engineers and specialists.

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DISTRIBUTION—Design

Steel Transformer Platform Serves up to 1,000-Kva Load

PAUL RIST, Supervisor, Substation Design, Arizona Public Service Co, Phoenix, Ariz.

Lower cost per kva installed, more platform space per structure, and a cleaner appearance are factors that prompted Arizona Public Service Co to use steel instead of wood for transformer structures. Savings in required ground area also follow the use of one steel structure where two wood structures would be needed.

Each steel platform will mount three, 333-kva, 12,500—120/208-v transformers with sufficient room for RA type switches and associated equipment. These structures are being used in the downtown areas of Phoenix where the load per square block ranges from 750 to 1,000 kva.

Main structure consists of 40-ft, 8-in.-wide-flange I-beams that hold the platform at 21 ft. Columns are set at 22 ft on centerlines. The platform consists of 10-in. I-beams that are 5 ft 5 in. long. Bolted joints are used throughout for the steel members. Beams are spray-metallized and finished with one coat of a vinyl sealer. However, local conditions indicate that galvanizing will be available on members of the size required.

Bolted to the platform beams are 4x6-in. timbers, onto which 2x12-in. planks are nailed spaced 1 in. apart. Space for oil disconnect switches, or disconnect switches and fuses, for cable services to building vaults is 7 ft 4 in. Net space for the transformers, which are individually fused, is 14 ft 8 in. The structure is designed so that oil switches may be operated either from ground level or from the platform directly. Disconnects are installed on the load-side of the switch to provide an open break for field maintenance.

The secondary bus is located on bus insulators above the transformers in a vertical plane between the main columns. Maximum bus size is 2-in. IPS copper tubing. Provision is made on the structure to support a 15-kv, 3-conductor bus to feed a 3-phase pre-spun or field-spun rubber insulated, neoprene-jacketed cable. In addition, provision is made to allow the take-off of cable feeds and secondary cable or open-wire secondaries from either end of the platform.

NEATNESS AND LOWER COST are two factors favoring steel over wood for transformer and oil-switch structures

Foundation for the structure consists of 8-ft, 30-in. diam reinforced concrete footings with bolts set on 12-in. centers. After the structure is erected and aligned vertically, space between the base plate and the top of the footing is grouted with non-shrinking cement. Then a 2-ft high concrete wheel guard is poured over the base plate. Erection time for each of the first three of these structures, with a four-man crew plus a crane and operator, was about 6 hr.

SUBSTATION—Operation

Primary Method Checks Protective Relays Speedily

R. M. RHOADES, Engineering Dept, Central Main Power Co, Augusta, Me.

Current circuits of all protective relays are now checked speedily and thoroughly by Central Maine Power Co with primary method. This consists basically of circulating current through the primaries of current transformers associated with the relay under test and checking the secondary current at various test points. With this method it is not necessary to disturb any connections, primary or secondary, during the check.

A single test simultaneously checks: The current transformer ratio, the secondary wiring, and the identity of each system phase with the corresponding relay on the switchboard. The primary method is also used to check the polarity of current-polarized ground relays as well as the calibration of automatic oscillographs.

To circulate the required primary current a high-capacity source is used. The source is rated at 2.5 kva, 0-1,000 amp, and is continuously variable in 8 steps. A 600-v, window-

(*Continued on page* 108)

One of many advantages of 90/10 Cupro-Nickel

WELDABILITY

Welding head on filter shell

One of the relatively new copper base alloys is 90/10 Cupro-Nickel, which is coming into increased use as a result of experience with it. Revere offers it in sheet and plate, pipe and tube. It is highly resistant to corrosion and erosion, particularly in salt or brackish water. In addition it can be cold or hot worked, welded, soldered and polished. Because its nickel content is less than the older 70/30 alloy, it is priced lower.

The item shown here is a 90/10 Cupro-Nickel filter for aviation gasoline, designed and fabricated by the Warner Lewis Company, Division of Fram Corporation, Tulsa, Oklahoma, for the U. S. Navy. Heads and shell are 1⅛" thick. Revere was given the opportunity to collaborate with the Warner Lewis manufacturers on welding, which was successfully accomplished by the metallic arc process, using Inco 70/30 Cupro-Nickel electrodes. The vertical weld on the shell was X-rayed 100% and found satisfactory to pass Navy inspection. Because of the thickness of the metal, it was decided to form the heads hot at around 1690° F. The forming was done by the Hackney Iron & Steel Co., Enid, Okla., which also consulted with Revere.

Warner Lewis Company of Tulsa, with representatives in 30 cities, are specializing on all types of alloy design and fabrication and inquiries of this nature are invited.

If you wish information regarding the selection, welding, or working of copper and its alloys and aluminum alloys, see the nearest Revere Sales Office.

Completed aviation gasoline filter, made of 90/10 Cupro-Nickel

REVERE

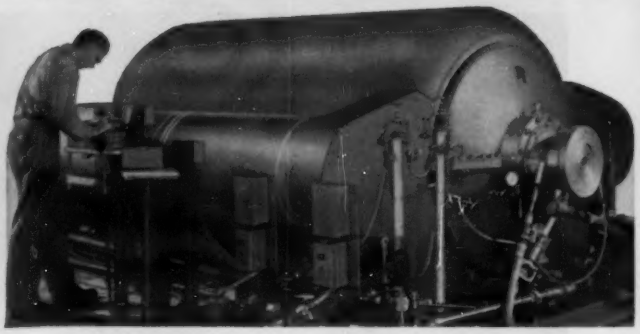
COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N.Y.

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

Fully Super



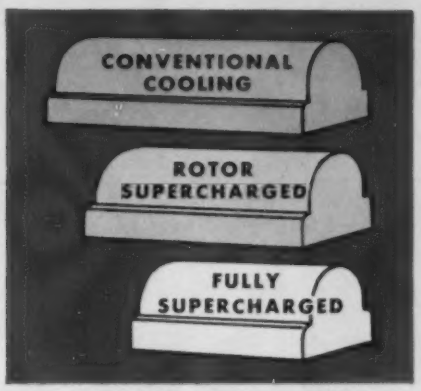
TEST UNIT establishes a basis for designing 3600-rpm units that can be rated 300 mw and higher. On initial test setup, the fully supercharged generator was given heat runs at various hydrogen pressures. Tests showed the output is more than doubled as a result of fully supercharged cooling.

Designers' model approximates appearance of fully supercharged generator on 150,000-kw steam turbine unit.

A-C ALLIS-CHALMERS

ALLIS-

charged cooling!



OUTLINES SHOW ADVANTAGES in comparable length . . . first with rotor supercharging . . . and now with full supercharging to reduce size even further.

Now

Allis-Chalmers reports on tests of a generator with supercharged cooling of both rotor and stator

EXPERIENCE shows that supercharged cooling pays off. The Allis-Chalmers pioneered development, applied to rotors only, already delivers important savings to utilities. Four steam turbine-generator installations now have a combined total of six years' operating experience. Plants can be smaller, less costly to build. Switchgear costs are lower. Shipping and installation are simplified. Important operating advantages have been proved.

A fully supercharged generator test unit — with supercharged cooling applied to both rotor and stator — has now been built. It has mechanical, magnetic and cooling features which permit maximum utilization of Allis-Chalmers supercharged cooling design. This design provides conductor cooling with high velocity gas flowing over ample exposed area.

Performance surpassed expectations

Test efficiencies exceeded predictions and temperatures were favorable. Electrical characteristics were exceptionally favorable. Mechanical features, including thrust-type hydrogen seals, proved unusually effective.

Overall tests show that fully supercharged cooling — of both rotor and stator — will provide steam turbine generators with advantages in size and performance far superior to previously built designs.

Complete information on these tests is available in "Fully Supercharged Generator — Performance Exceeds Expectations." Get a copy from your nearby Allis-Chalmers office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-4661

CHALMERS

Primary Method for Checking Relays

(*Continued from page* 104)

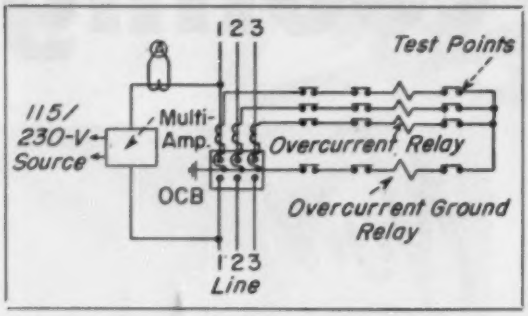


FIG 1—HIGH CURRENT SOURCE connected across OCB's bushing CT supplies current for testing relay operation

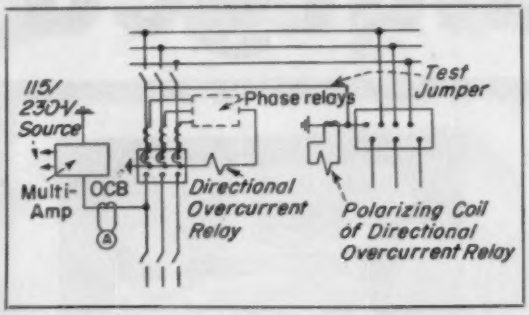


FIG 2—TRIPPING DIRECTION of current-polarized, ground relay is checked speedily with high-current source

type, instrument CT and suitable ammeter are connected in the test leads to indicate primary current.

Before the current source was commercially available, a modified wound-type CT was used with a variable voltage control. But this did not have the range or the capacity of the commercial set now used.

Most of the checking is done on new 115-kv and 34.5-kv equipment where relays receive current from bushing-type CTs in oil circuit breakers. For this type of installation the current source is connected across the bushing of one phase, Fig 1. The current source is adjusted to circulate 5 amp in the secondary circuit while an ammeter is inserted in the various test points provided. The same check is repeated on all three phases.

The second part of the primary test checks the tripping direction of ground relays which are current polarized. The operating coil of the relay is connected in the residual lead of the bushing CT on the OCB and the polarizing coil is in the secondary of a CT in the neutral lead of a grounded-neutral power transformer. Therefore, this particular check cannot be made on power transformers having CTs in the neutral bushing.

To facilitate this test Central Maine Power has standardized on external neutral CTs for all grounded-neutral power transformers. The current source is connected, as in Fig 2, with the two primary circuits in series across the current source. Current is passed through this circuit. And if all secondary connections and polarities are correct, the ground relay will trip the breaker. An important advantage of this test is that it can be conducted with the power transformer energized.

The high-current source is also used to calibrate automatic fault recording oscillographs on the transmission system. The connections are similar to Fig. 1. And desired primary current can be circulated to adjust the deflection of the galvanometer in the secondary circuit.

DISTRIBUTION
Operation

Compact Unit Trims Trees in Congested Areas

H. HEINRICH, Manager, System Operation Dept, Hawaiian Electric Co, Honolulu, Hawaii

Tree-trimming in congested locations is implemented by one vehicle that combines three pieces of equipment into one. Designed and built by Hawaiian Electric Co, the vehicle has a hydraulic ladder, air compressor, chipper, and side-dump body.

Operated by a crew of three, the unit replaces equipment that required four men. During the several months it has been used, the vehicle has permitted efficient operation, particularly

(*Continued on page* 113)

THREE-IN-ONE tree-trimming unit has a hydraulic ladder, a side-dump body, a chipper, and an air compressor

two of each three are strung on O-B

Miles, that is! Two-thirds of the extra-high voltage circuit-miles in North America are strung on Ohio Brass Insulators. *Every* extra-high voltage project in North America has chosen O-B for all or part of the suspension insulator requirement. This, we think, is excellent proof of the industry's faith in the quality and performance of Ohio Brass products.

Since the EHV transmission requirements that call for the best insulators apply equally to the hardware, it is worthwhile to point out that only Ohio Brass Company maintains an organization which designs, produces, tests, and evaluates the insulator-hardware combinations needed for EHV transmission.

Constant use of these research facilities keeps O-B attuned to the needs and problems of the electric utility industry. It also keeps O-B products at the quality level that encouraged their selection for two-thirds of the EHV circuit-miles in North America!

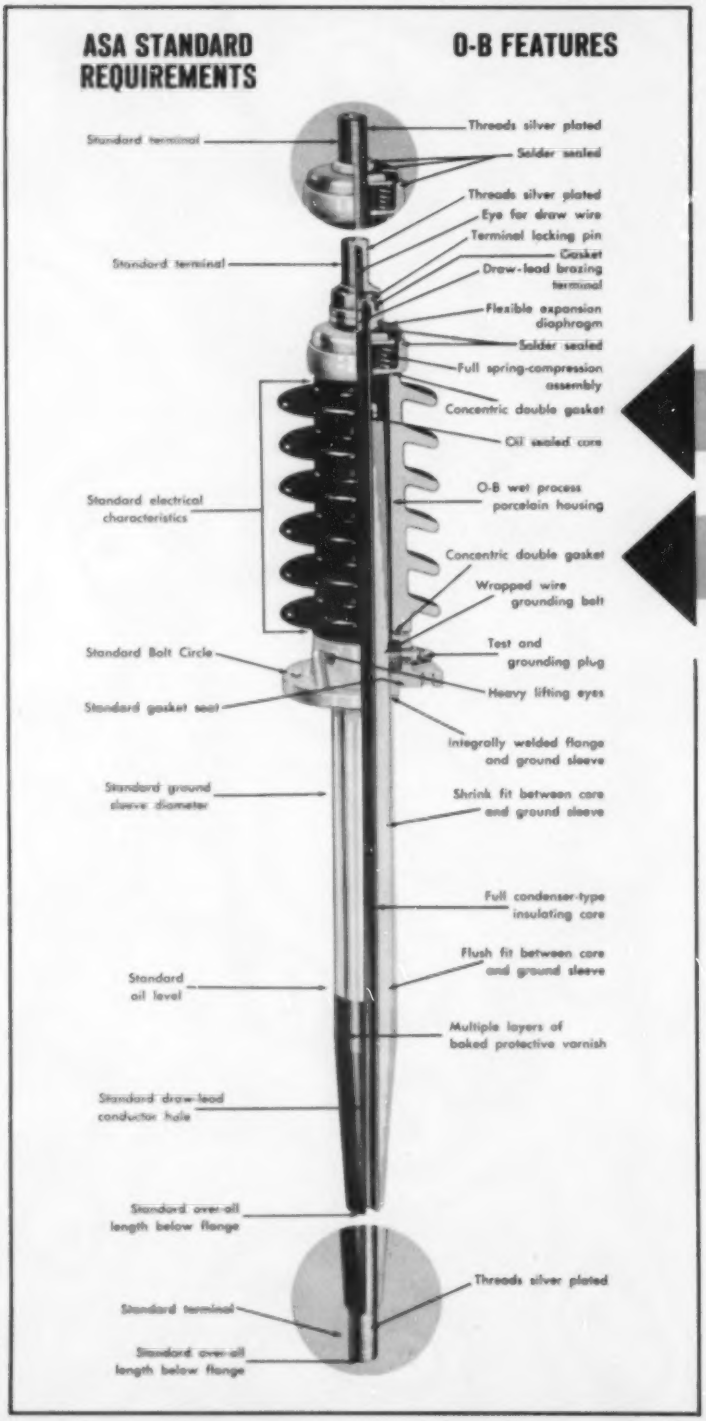
OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Deadends on 330-kv construction. Insulators, yokes, and control rings furnished by Ohio Brass Company.

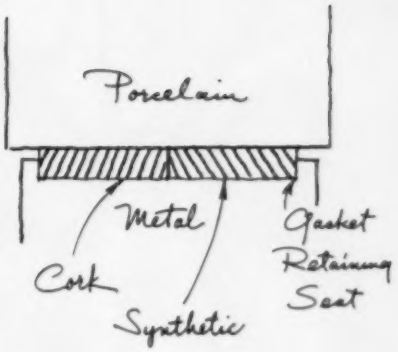
Ohio Brass

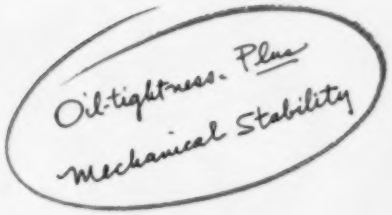
FEATURES OF
O-B'S NEW ASA STANDARD BUSHINGS

(Drawn-lead transformer type in full view. Fixed conductor type insets.)



Ingenious Double Gaskets Add To Reliability of New O-B Bushings





In addition to its electrical function, oil in O-B's new ASA Standard bushings establishes a "dry" environment for the wound paper condenser-type insulating core. Since air containing water vapor would replace any oil loss, efficient sealing becomes a vital part of modern bushing design.

To compensate for dimensional differences due to thermal expansion, and for the inevitable slight loss of gasket volume, positive controlled follow-up pressure is obtained by full spring compression assembly.

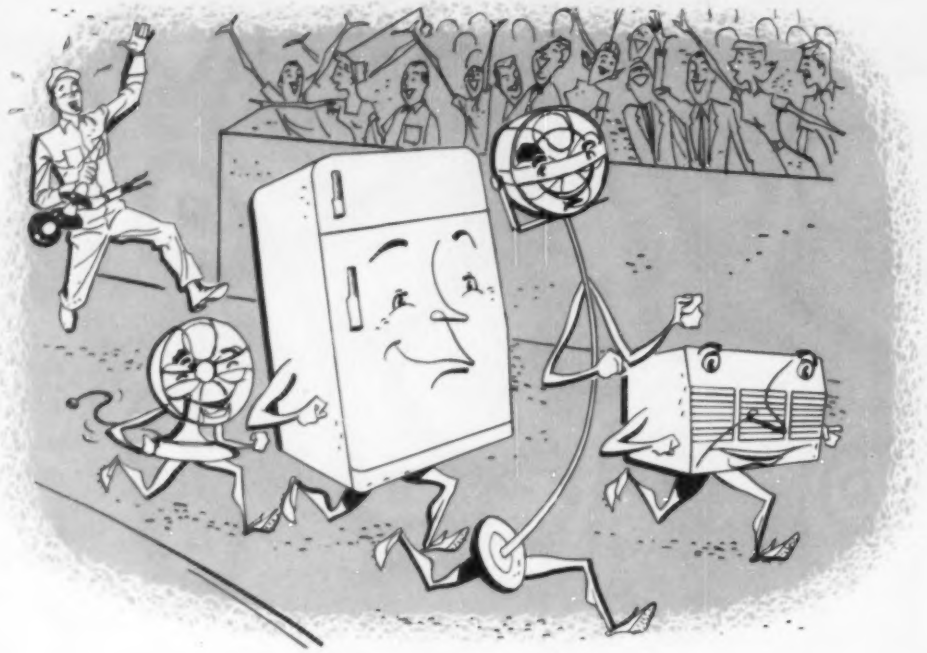
Special oil-tight gaskets are an ingenious new development in the O-B bushing. Cork has high compressibility. Synthetics have ideal sealing power. The simple expedient of two concentric rings, one of each material, produces a mechanically stable and oil-tight joint. The two substances perform their best function independently, and joints are maintained at optimum working load by adequate follow-up spring pressure.

Result of this new sealing technique is a permanently reliable oil-tight joint -- a permanently reliable "dry" environment for the insulating core -- a big contribution to the over-all permanent reliability of the entire bushing.

To get this and many other modern features of design, be sure to *specify* O-B's new ASA Standard bushings on your requirements for transformers and circuit breakers.

TECHNICAL COMPETENCE the heart of every Ohio Brass bushing

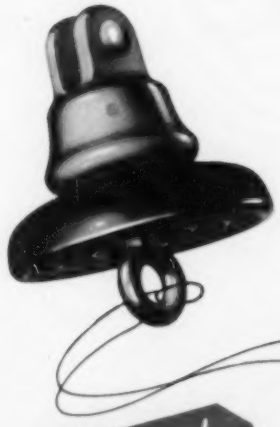
The Kilowatt Sweepstakes



As air conditioners, fans, freezers and what-not join the summer "beat the heat" race, distribution people may feel that it "takes all the running you can do to keep in the same place"!

With added transformer capacity, capacitors, more and heavier lines, you may win the first lap in the kilowatt sweepstakes. But to win the race, many companies plan to stay ahead of the summer heat load by raising distribution voltages. They're rebuilding deadends on overtaxed primaries now -- whenever a crew is in the area. In new construction, they build for the higher voltages. Many have already raised to 12 and 13 kv; some are going to 22 kv distribution. They're using two and three 6-inch suspensions at the deadends!

Perhaps you're planning to raise voltages, too, and find your rebuilding can't be scheduled rigidly. To be ready without keeping large inventories, rely on Graybar to keep stocks of O-B insulators and hardware on hand. And, as you look ahead to new construction, let O-B - Graybar teamwork keep your insulators and hardware ready for delivery when and where you want them!



OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

Ohio Brass

GraybaR QUALITY SINCE 1869 *REG U.S PAT OFF Distributed by GraybaR ELECTRIC COMPANY ©

4535-H

Tree-Trimming Unit

(*Continued from page* 108)

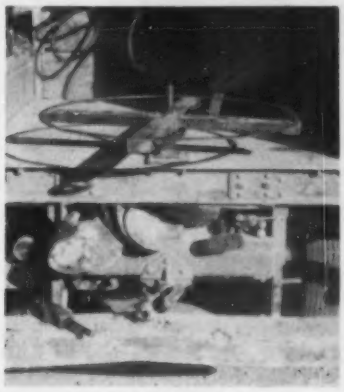
in areas not readily accessible to the older equipment.

The truck is a 19,000-lb, 111-in. wheel-base type with a power-tilt cab over the engine for easy maintenance. Mounted on the truck chassis are a 35-ft hydraulic ladder powered by a 2½-hp gas engine, a 16-cfm gas-engine driven air compressor, and the chipper. Mounted between the ladder and the chipper is a 5-yd side dump enclosed body. Power take-offs from the truck engine drive the chipper and also the dump body through a hoist.

During trimming, one helper works from the ladder while the other helper and the driver feed trimmings into the chipper.

Total cost of the unit was about $11,000, including $4,500 for the truck, $2,000 for labor and fabrication of the side dump body, and $4,500 for other parts. HECo supplied all components except the side dump body, which was fabricated locally.

DISTRIBUTION—Operation

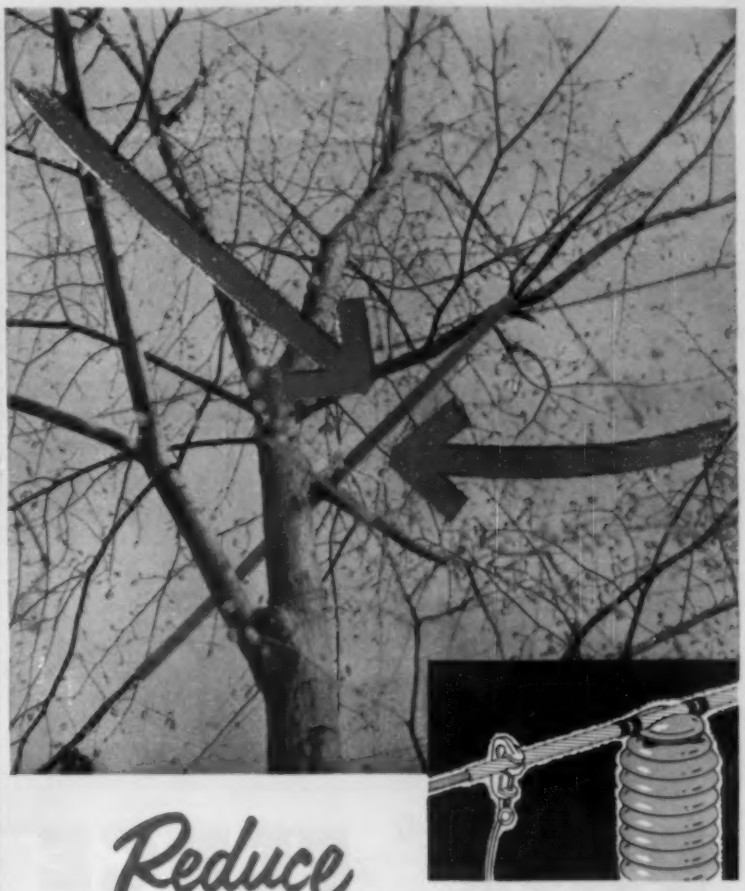


Pay-Out Reel Support Aids Wire Handling

R. L. WARE, System Supt of Distribution, Virginia Electric & Power Co, Richmond, Va.

A support for a pay-out reel, developed by Virginia Electric & Power Co, fits into a socket that is already available in the bed of the line truck. Because the removable support is mounted near the rear of the bed, reels of wire can be easily positioned,

(*Continued on page* 114)



Reduce

TREE TRIMMING

LINE GUARDS or ARMOR RODS

Line guards, a development from ARMOR Rods are used, like ARMOR Rods, to protect against arcover, chafing and mechanical wear due to concentrated stresses.

Reduce maintenance expense . . . improve customer good-will by protecting your conductor with Preformed Line Guards. Metal or plastic guards available...all are accurately formed to fit snugly without loosening. Easy to install—no tools needed.

These exclusive guards assure positive protection against the abrasive rubbing of tree limbs, corners of buildings, poles and other damaging objects. Dangers of grounding are eliminated . . . insulation life prolonged indefinitely. Conductor maintenance is nil.

For longer care-free service—a greater safety factor, specify Preformed Line Guards.

● *For complete details of their exclusive advantages, write or telephone Cleveland: EXpress 1-3571.*

PLP **PREFORMED LINE PRODUCTS CO.**

5349 ST. CLAIR AVENUE · CLEVELAND 3, OHIO

a new, superior system of
CABLE and TUBING race ways
GLOBE'S CABLE WAY
Easy to Install
Saves Time
Saves on Material
Galvanized
No Maintenance problem
A completely engineered system of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The universal splice plate joins all parts through the side channels only. All curved fittings are joined at the end of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.
Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point—insides and bottom always smooth—all sections punched for easy installation—perfect fit at all times. Neat, clean and uniform in appearance.
Write for new complete catalog.
Distributors in all principal cities.
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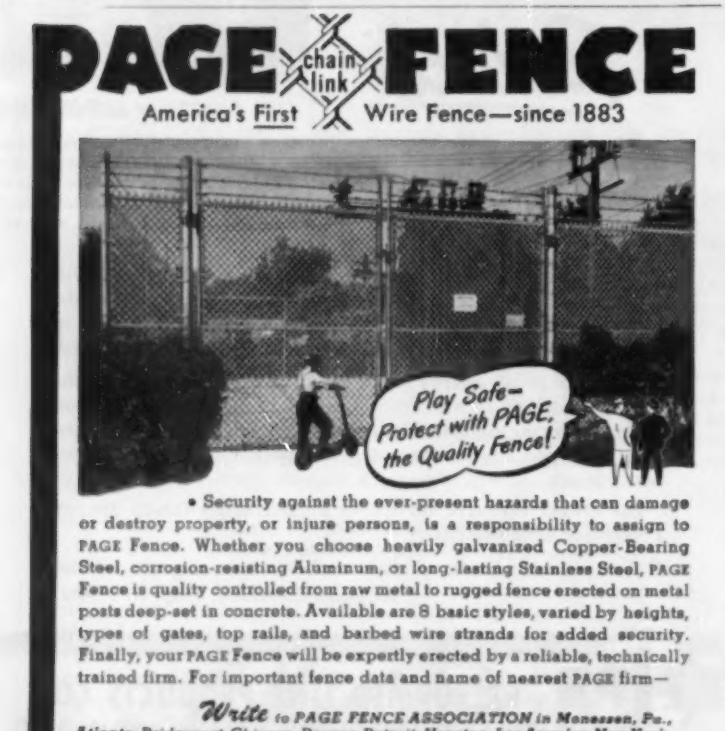

PAGE chain link FENCE
America's First Wire Fence—since 1883
Play Safe—
Protect with PAGE,
the Quality Fence!
• Security against the ever-present hazards that can damage or destroy property, or injure persons, is a responsibility to assign to PAGE Fence. Whether you choose heavily galvanized Copper-Bearing Steel, corrosion-resisting Aluminum, or long-lasting Stainless Steel, PAGE Fence is quality controlled from raw metal to rugged fence erected on metal posts deep-set in concrete. Available are 8 basic styles, varied by heights, types of gates, top rails, and barbed wire strands for added security. Finally, your PAGE Fence will be expertly erected by a reliable, technically trained firm. For important fence data and name of nearest PAGE firm—
Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia or San Francisco.
PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

Support of Reel

(*Continued from page* 113)

and wire is readily accessible.

The support consists of a rectangular block about 8 in. long with a shoulder welded on two sides near the center. On top of the block is a spindle which serves as an axle for the pay-out reel. The bottom of the rectangular block fits into a socket normally used for the sheave block bracket.

J. D. Greenwood, of the company's Potomac District, developed the support. An unmounted support is resting on the rear step of truck in the accompanying photo.

GENERATION—Maintenance

PROTECTIVE SHOES, made of scrap fiber, fit over exciter's opposite poles to assure greater safety for workmen

Fiber Shoes Prevent Shorting of Brushes

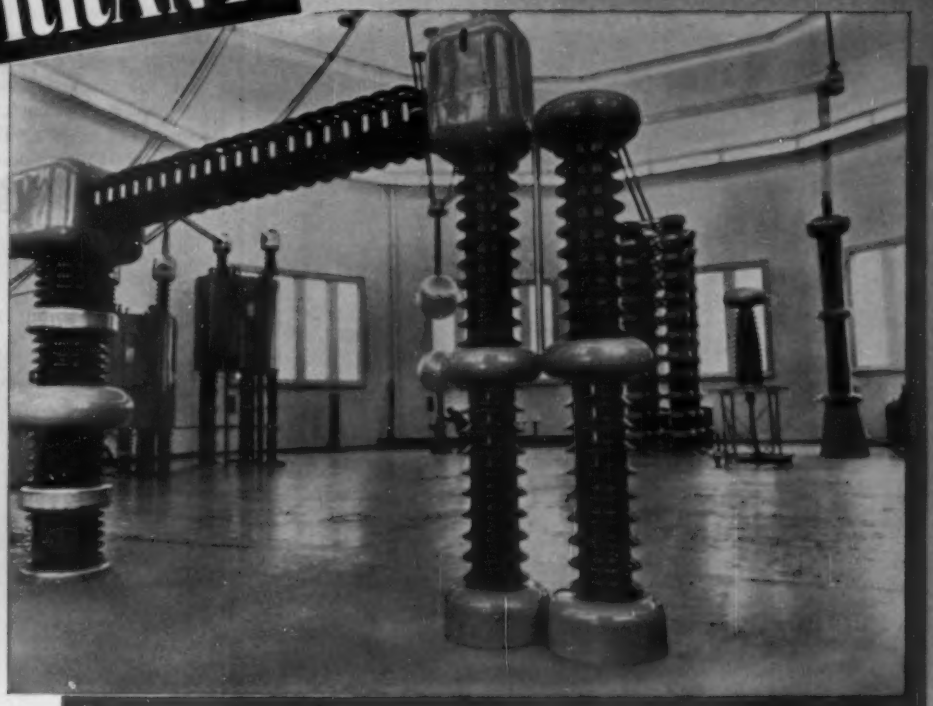
OLIN STROLE, Phoenix Power Plant, Arizona Public Service Co., Phoenix, Ariz.

Low-cost and simple safety "shoes" prevent short circuits while changing brushes on generator exciters. Preventing short circuits eliminates disturbances to the machine and removes the chances of injury to the operator's eyes from the arc.

(*Continued on page* 116)

FERRANTI

HIGH VOLTAGE TESTING EQUIPMENT



IN NORWAY

The Testing Equipment illustrated has been supplied by Ferranti Ltd to the Research Laboratory of Standard Telefon og Kabelfabrik A/S, Oslo, Norway. It consists of :

Foreground : 1,000,000 volt D.C. Testing Equipment.

Left . 600 kV, 1,200 kVA , A.C. Testing Equipment.

Background : 12 Stage 2,000,000 volt Impulse Generator.

A 1,500 mm sphere gap and surge potentiometer can also be seen in the background.

TRANSFORMER CAPACITY OF OVER 5,000,000 kVA PER ANNUM

The Ferranti transformer plant at Hollinwood, Lancashire, England, covering an area of over 300,000 sq. ft. has a manufacturing capacity per annum of over 5,000,000 kVA of Large Power Transformers, Distribution Transformers, Voltage Regulators, High Voltage A.C., D.C., and Impulse Testing Plant and Specialised Equipment. Contracts include the supply of transformers for the Garrison Dam and McNary Dam Projects in the U.S.A. and the Alcan Project in Canada.

FERRANTI LTD. Head Office and Plant : HOLLINWOOD · LANCASHIRE · ENGLAND

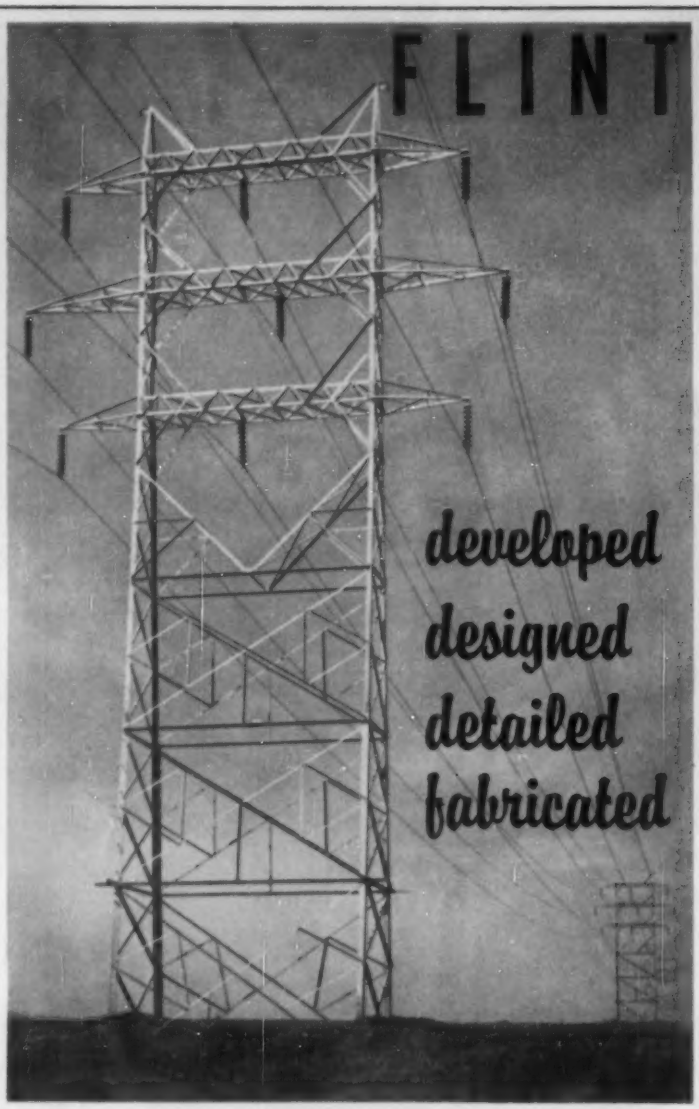
PLANTS AND OFFICES

NEW YORK : Ferranti Electric Inc., 30 Rockefeller Plaza, New York 20, N.Y.

TORONTO : Ferranti Electric Ltd., Mount Dennis, Toronto 15, Ontario.

MANCHESTER, ENGLAND : Ferranti Ltd. Moston, Manchester 10.

EDINBURGH, SCOTLAND : Ferranti Ltd., Ferry Road, Edinburgh 5.



this unique Triple-Circuit Tower for 138 KV Transmission

Since this tower is only one of two of its kind known to exist, we're proud of this fact. It was the *completely integrated* service offered by Flint Steel that made it possible. From the original idea to time of erection, Flint was there. Whenever *you* build *anything* with galvanized structural steel why not take advantage of this unusually complete Flint service.

FLINT STEEL

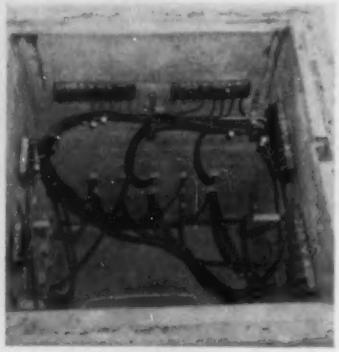
TULSA
MEMPHIS

Fiber Shoes for Brushes

(*Continued from page* 114)

Protective fiber shoes, designed by the author and made from discarded bus connection protectors, are fitted over the exciter's opposite poles. The shoes are attached to the brush assembly holder by using existing clamps and one added bolt. They are a permanent part of the machine and provide good insulation when carbon and graphite brushes are checked or replaced.

SUBSTATION—Design



Special Terminations Aid Tapping of UG Circuits

G. W. MURDOCK, Asst Electrical Engineer, Pennsylvania Electric Co, Johnstown, Pa.

Pennsylvania Electric Co is installing special terminations at substation manholes for dc control circuits and ac lighting and heater circuits. The terminations, comprising a single bus with multiple junctions and an insulated cover, provide an economical and convenient means of tapping the main feeder circuits in the manhole.

Feeder circuits run from the station battery and ac fuse panels in the control house through ducts to manholes in the substation yard. Here they connect to the multiple-junction terminations from which branch circuits run to various operating points. As new branch circuits are required, they may be added without disturbing existing cables or splicing, thus saving installation time.

The terminations are mounted on the manhole wall. This separates the circuits to permit quick identification and eliminates the possibility of physical damage to cables.

Country-Wide Field Stocks Provide Fast Service

ALLIS-CHALMERS
DISTRIBUTION TRANSFORMERS

Extend Your Own Transformer Stocks by taking advantage of the strategically located stocking points for Allis-Chalmers distribution transformers. From every part of the country you can get fast, convenient shipment to meet your day-to-day needs.

Local stocks maintained for customer convenience by Allis-Chalmers include conventional distribution transformers as well as self-protected and overload-indicating transformers. Stocks include instrument transformers. All units are available in most popular ratings.

Check your distribution transformer needs today. Find out how nearby A-C stocking points can help you solve the stocking problem. Contact your nearest A-C distributor or office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

Bonus-Pallet Crates Cut Warehousing Costs

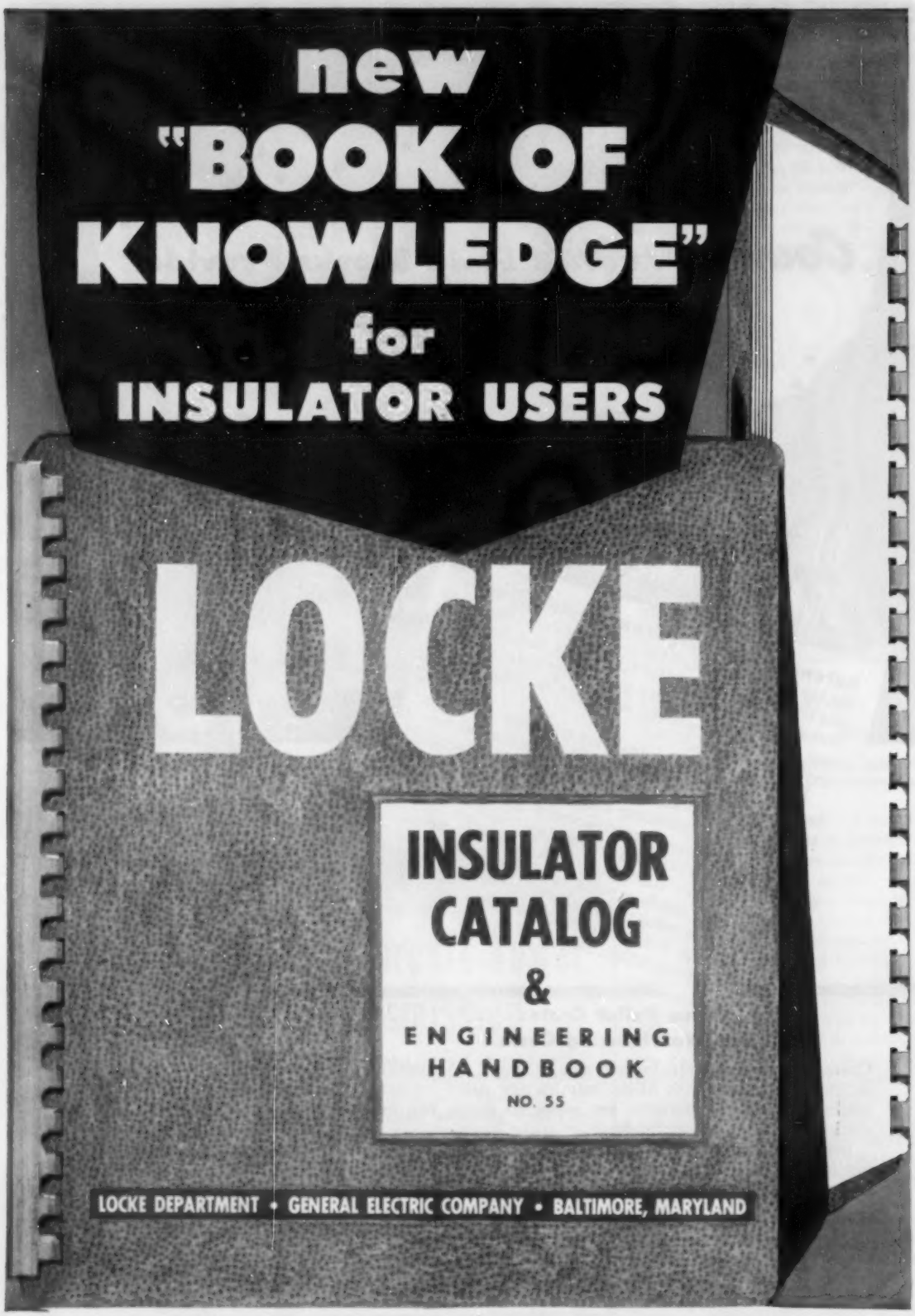
Crated distribution transformers can be stored more easily in your warehouses with Allis-Chalmers new pallet-bottom crates. Crated transformers are easier to move, can be stacked higher and more safely.

Best of all, when the transformer is removed, the crate bottom can be removed from the crate and converted into a re-usable pallet for handling other materials.

A-4782

A-C

ALLIS-CHALMERS


new
"BOOK OF KNOWLEDGE"
for
INSULATOR USERS
LOCKE
INSULATOR CATALOG
&
ENGINEERING HANDBOOK
NO. 55
LOCKE DEPARTMENT • GENERAL ELECTRIC COMPANY • BALTIMORE, MARYLAND

Locke's Insulator Catalog and Engineering Handbook

Designed to become your favorite source for complete, authoritative purchasing and engineering information on insulators and insulator hardware.

Included in its 233 pages of easy-to-use, alphabetically and numerically indexed material, you'll find these important features:

1. A completely new insulator product section, thumb indexed, makes it easy for you to quickly locate any one of over 800 insulators or insulator hardware items.
2. Complete description of physical characteristics of porcelain.
3. Six pages of clamp recommendations for various conductors.
4. Large section on lightning performance of transmission lines.
5. An expanded section on apparatus bushings with application and maintenance information.
6. Complete listing of all EEI-NEMA Standards, including proposed standards for apparatus insulators. (TDJ-58, 59)
7. The complete American Standards for apparatus bushings and test code.
8. A large general data section including standard insulator tests, cable specifications and many valuable tables for general calculations.

Your copy of this lightweight, spiral bound Insulator Catalog will be supplied by your local Locke Representative.

LOCKE

Vermiculite Ore Handling Improved

- **Vibrator was inexpensive answer to clogged hopper feed**
- **Products improved, and plant efficiency increased**

J. M. JENNINGS, JR., General Sales Dept, New Orleans Public Service, Inc, New Orleans, La.

A given amount of vermiculite ore is going further now in the manufacture of lightweight building materials used in cast roof slabs, house insulation, and plaster, because Zonolite Co's Central Div plant in New Orleans installed a small industrial vibrator.

It takes only 40 w at 120 v, yet has eliminated packing of the vermiculite as it feeds a conveyor belt from a hopper. Now that the ore flow is even, a better finished product is being obtained. And the company is producing more products per ton of raw material.

This mica-like ore is expanded in a furnace to produce lightweight materials for the building industry. It is transferred by an electric elevator and conveyor system from the railroad's freight car to storage tanks or bins.

VIBRATOR FREQUENCY can be adjusted continuously through a range from zero to 110 per sec, thus enabling vermiculite ore to be fed properly to the conveyor

The bins each hold about 30 tons, and should discharge about a ton of vermiculite an hour. A conveyor carries the ore to the furnace.

Although of a relatively low density, the height of the ore in the bin causes the mineral to pack and discharge irregularly when gravity flow is relied upon. This former system proved costly because complete expansion of the vermiculite occurs only if the ore travels through the furnace at regular rate. A poorer grade of finished products resulted, and the optimum volume of product per ton of raw material was not being obtained.

Reflector Lamps End Mill's Dust Problem

RALPH SEGABARTH, Power Salesman, and W. W. NENTRUP, Lighting Engineer, Public Service Co of Indiana, Inc, Plainfield

BEFORE: Dusty 1,000-w lamps dotted alternate bays and provided only 3 ft-c

Lighting problems at the dust-filled Kerber Mill of Indiana Limestone Co were solved by the installation of R-52 reflector-type lamps. The 750-w R-52's are mounted on 18-ft centers, 18 ft from the sides and ends. They are hung 35 ft high on spring suspension. Initial lighting intensity was 26 ft-c, and, after three months, 23 ft-c.

This provides good lighting for the exacting seeing tasks that prevail in the mill. This type of lamp is least affected by severe dust conditions, and is easy to clean.

Formerly the mill was lighted by 1,000-w PS-52 lamps in RLM dome reflectors. Only one lamp was provided in every other bay. Illumination at the work level ran about 3 ft-c.

AFTER: Now easily cleaned 750-w R-52 lamps shed 23 ft-c at the work level

For Troublefree Substation Performance

CHANCE Type H Rotating Stack Switches

Only 3 Moving Parts

Easy to Install

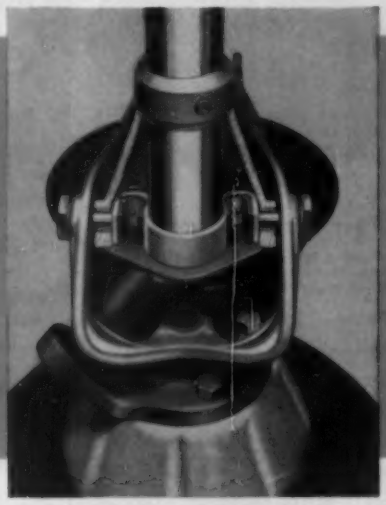
Continuous Hinge Contact

Switching operations on today's heavily loaded power systems demand rugged switches that are simple in design and have the ability to give years of unfailing performance—without maintenance—under any climatic conditions.

Chance Type H Rotating Stack Switches meet these demands because of features like *continuous hinge contact*. The contacts at the hinge end of *all* Type H switches are held under constant pressure in both the open and closed positions. U-shaped pressure springs carry no current and support no weight. The blade closes with a rotating motion that makes a clean, high-pressure contact . . . ice accumulations are broken with ease.

Outdoor
Group-Operated
Airbreak
7.5 through 230 KV
400—600—1200
Amperes

Cutaway view at right shows the hinge exposed. Contacts are completely enclosed at all times . . . protected from oxidation and corrosion. Pressure springs are made from beryllium copper.

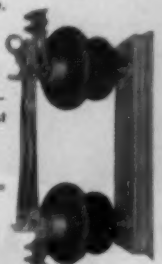


There are only three moving parts on the Type H—this means years of dependable, trouble-free performance. A universal control crank makes it easy to adjust the controls to within 5° of any position and permits the control mechanism to be easily adapted to any structure.

USE CHANCE HOOK STICK SWITCHES, TOO!

Chance Hook Stick Switches are rated from 7.5 through 115 KV, 400—600—1200 Amperes. All meet NEMA and AIEE requirements and all pass the most severe tests for high currents, icing, insulation characteristics and long life.

Write today for complete information on these Chance Switches.



CS54-23

ABC INDUSTRIES

A·B·CHANCE CO.

CENTRALIA, MISSOURI • SAN FRANCISCO, CALIFORNIA

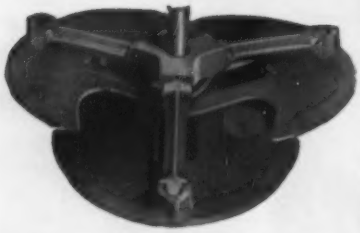
The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power

QUICKLY Installed

TOUGH For long life



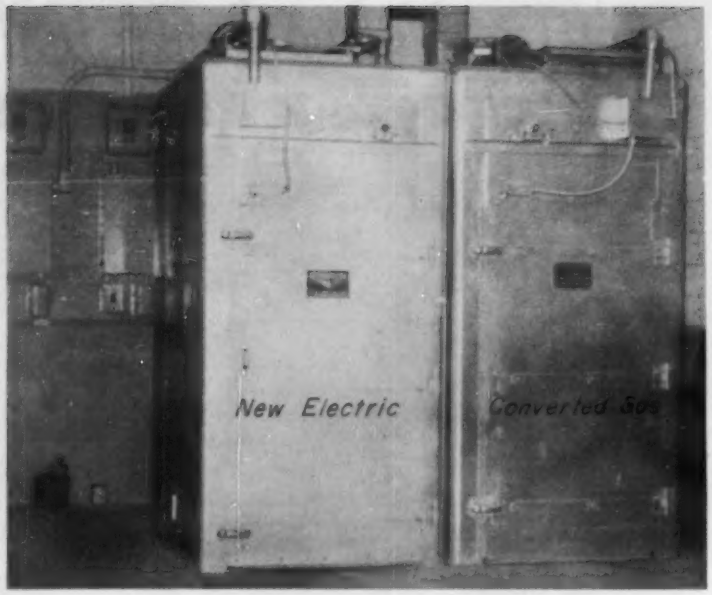
● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO

Manufacturer of "THE ANCHOR OF MERIT"

FAIRFIELD, IOWA



Oven Conversion Was Best Answer

V. C. SCHUMACHER, Industrial Power Engineer, Ohio Power Co, Bacyrus, Ohio

Converting baking ovens from gas to electricity enabled the Power Equipment Co of Galion, Ohio, to cut costs in an expansion program. The ovens bake varnish-impregnated transformers and saturable reactors.

The units were converted, and now require 30 kw each. Significantly, a third 30 kw electric oven has been installed, and a proposed fourth is in the works.

When the company expanded to a new site beyond the city limits, it decided not to have gas lines extended to the new plant. To keep the ovens working, company officials first thought about trying an oil-fired muffle arrangement, or bottled gas. But when shown how simply the ovens could be adapted to electricity, they resolved to make this change instead.

The electric arrangement yielded space savings, and lower installation and operating costs.

Caskets Get Hydraulic Lift from Basement to 1st Floor

R. L. GRENNAN, Power Service Engineer, Public Service Co Div, Commonwealth Edison Co, Northbrook, Ill.

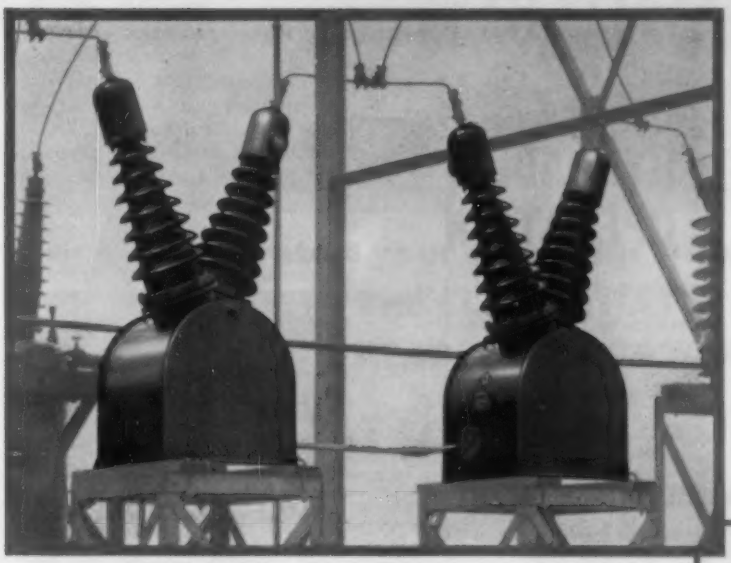
At Black's Funeral Parlor in Arlington Heights, Ill., the casket display space is in the basement. After a casket has been selected it is brought to the first floor. In Black's old location a considerable amount of time and energy was consumed in moving caskets up and down the stairs.

So Black installed a hydraulic hoist, similar to those in garages and gasoline service stations. The caskets are wheeled onto the hydraulic hoist. A push of a button moves the hoist to the desired level. The motor on the hydraulic system is 1½ hp.

These 69-kv Potential Transformers are

800 lbs. LIGHTER

than older types



...were lifted into place with a set of rope blocks

Take advantage of these compact Allis-Chalmers current and potential transformers for outdoor circuits through 161 kv. They take less space, need less foundation or mounting structure than older designs.

138-kv potential transformer

All-welded tanks, one-piece porcelain HV Bushings

Tanks are all-welded, hermetically sealed to protect insulation and oil from deterioration. Unique bushing construction provides for an oil reservoir common to both bushings and tank, reduces oil requirements, cuts weights. Porcelain high voltage bushings can be replaced at a fraction of the cost of older types.

Corona-free design

Corners and edges of coil assembly are protected by formed insulating channels which fit closely to the coil surfaces, effectively preventing formation of corona or development of leakage paths. Tests prove the design will withstand long, continued overvoltage stress and short-time surge conditions.

Get more information on these modern compact units from your nearby A-C office or write Allis-Chalmers for your copy of "PT's Are Getting Smaller." A-4710

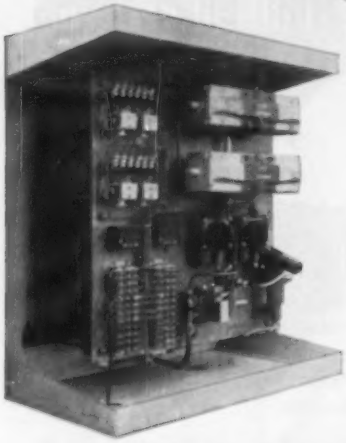
ALLIS-CHALMERS

INVESTIGATE

Hydraulics

FOR GROUP OPERATED

AIR BREAK SWITCHES



HYDRAULIC OPERATION

originated by Royal, has proven to be a revolutionary contribution to the field of switch operation.

HYDRAULIC OPERATION HAS SEVERAL UNIQUE ADVANTAGES:

- Smoother, easier, more positive action and less subject to external interference
- Simple copper tubing, instead of mechanical linkages, carries the actuating force
- Switches can be operated at considerable distances from mechanism
- Tubing conforms to the shape of any switch-supporting structure
- Ideal for either new or existing group-operated switches
- Dependability now proved in more than 150 installations

Now available in several types . . .

—for remote operation from any a. c. or d. c. voltage, Type JHM
—for storage battery operation, Type JHM-6
—with energy stored in an hydraulic accumulator, Type JHA

May we send you our descriptive bulletin?

Royal

A Part of the Arsenal of AMERICAN POWER PRODUCTION

ROYAL ELECTRIC MANUFACTURING COMPANY
INCORPORATED
1122 EAST 87th STREET Chicago 19, Ill.

INDUSTRIAL BRIEFS

Drying pill coatings with processed air heating has enabled the Vale Chemical Co, Allentown, to increase production and build up a stockpile of the pharmaceutical. The stockpile was desired because the company soon will move into new quarters and needed to continue supplying pills to its customers although production would be at a standstill temporarily. A process air heating application had been designed for the company's new quarters, but when it was discovered that the company's stockpile was inadequate, the new process air heating application was put to work immediately in the old plant. The heating system consists of fin-type strip heaters installed in the air ducts. K. E. Orben, Industrial Representative, Pennsylvania Power & Light Co, Allentown, Pa.

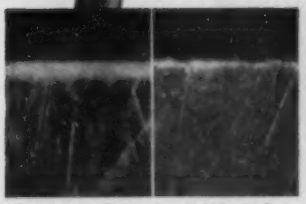
Spray-painting bicycle parts with an electrostatic system has cut "flamboyant paint" consumption 40% for Cleveland Welding Co, Cleveland, Ohio. Parts dangle from a conveyor moving 12 to 16 fpm through a 24-ft-long spray booth. Charged negatively, the lacquer is slung at the positively charged parts by spinning bells fed from a hose. Little paint is wasted, and touching up by a hand-spray man is minimized. The wet parts then zip through an overhead 240-kw infrared oven, emerging four minutes later. Drying formerly required an hour in a convection oven. J. G. Price, Advertising Writer, Cleveland Electric Illuminating Co.

Brazing small gears on shafts at James and McDonald Co's plant in Chicago is accomplished in an 18-kw resistance furnace. Gears are slipped on shafts to which silver solder is added. As the assembly passes through the furnace, the solder melts and distributes itself properly. Time and temperature are controlled to yield the desired braze. Temperature ranges from 1,400F to 1,500F. It takes 8 to 9 min to braze a batch. This electric installation has presented these advantages over the system formerly used: Less maintenance, which translates into steadier production; reduced losses from leaks; better control of atmosphere, and quicker brazes. G. A. Soule, Power Sales Engineer, Commonwealth Edison Co, Chicago.

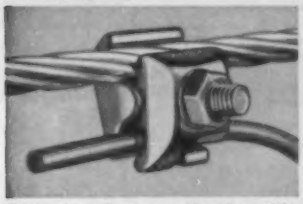
One AGP* clamp for all connections

ALUMINUM TO COPPER • COPPER TO COPPER
COPPER TO ALUMINUM • ALUMINUM TO ALUMINUM

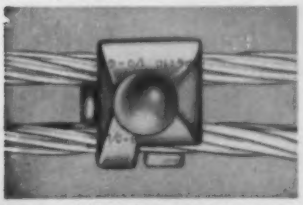
Protect your conductor with THE CLAMP THAT'S AHEAD OF THE TREND



Micro-photograph shows how high-density fortified cadmium, applied to a thickness of .001" on Chance AGP Clamps, compares with commercial plating at right.



Overlapping contacts on one side and a straight slide-in groove on the other help the attachment of the tap to the line.



Top view of clamp shows extra wide gripping jaws that contact all outside conductor strands in the entire size range.

Connecting copper and aluminum conductor requires a general purpose connector as good as the conductor itself in conductivity, mechanical stability and corrosion resistance, if future trouble on the line is to be avoided.

The best connector for this purpose is an aluminum bodied clamp with a *properly applied coating* of high density, fortified cadmium, proved best by every test for long-lasting, troublefree, general purpose connections.

That's what you get in the New Chance AGP Parallel Groove Clamp, companion to the widely tested and accepted Chance AGP Tap Clamp. The Chance PG110, shown above, can be used for any combination of aluminum or copper in a size range 1/0 ACSR to No. 6 copper *both sides*. This clamp is heavy in construction—yet light in weight. The high tensile strength bolt swivels into position without binding or bending. The wide jaws of this clamp contact every strand of any conductor in the entire size range. Rounded edges protect the conductor against damage from vibration.

Chance PG110 is your universal clamp for most applications. Larger sizes with the same features are also available. Write for complete information.

*Aluminum General Purpose

FORTIFIED CADMIUM ...proved best by test for joining aluminum and copper conductors

Read these Statements!

They're from leading manufacturers of aluminum conductor, power companies, and research laboratories. (Names on request).

* * *

"Where outdoor weather resistance is required, *cadmium is the best metal to deposit on aluminum.*"—Laboratory.

* * *

"This is the most logical solution to the problem of making aluminum to copper connections."—Conductor Manufacturer

* * *

"All factors considered—corrosion, electrical requirements, service—cadmium plated aluminum connectors, plated according to the method used by the Chance Company, are the best possible combination for use on aluminum conductor, for aluminum or copper taps."—Conductor Manufacturer

* * *

"Your AGP connector, cadmium clad as you do it, is going to solve one of our greatest problems of making lasting A and C connections."—Power Company

* * *

"The value of cadmium plated coatings has been completely demonstrated. Their high resistance to atmosphere, corrosion, to salt spray and to alkali has made them outstanding as a corrosion-resistant coating."—Laboratory.

* * *

"I prefer cadmium because of its outstanding resistance to corrosion in contact with aluminum and because of its inherent low contact resistance."—Conductor Manufacturer

* * *

"Our research laboratory found an average cadmium coated thickness of .002" on your AGP clamps. This is considerably more than the .0005" coating implied by ASTM specification A-165 Type N.B."—Aluminum Manufacturer

* * *

"Your AGP clamps were subjected to approximately 500 hours in a humid sulphide atmosphere and after cleaning to remove the sulphide coating which had formed on the exterior they showed no evidence of a breakdown of the fortified cadmium plating."—Eastern Utility

ABC INDUSTRIES

A·B·CHANCE CO·

CENTRALIA, MISSOURI

SAN FRANCISCO, CALIFORNIA

THE BEST TRANSFORMER DESERVES *and gets it*

When you buy Moloney Hiper-Core Distribution Transformers . . . you expect the best . . . and you get it . . . right down to the paint. Experts agree that the best protective surface is a heavy coat of the highest quality paint.

Moloney HiperCore Transformers are painted with a heavy coat of Moloseal . . . the finest paint, custom made to protect transformers.

MOLOSEAL CONTAINS THESE INGREDIENTS TO PERFORM THESE FUNCTIONS:

PRIMER	FINISH COATS
LEAD CHROMATE, RED LEAD } for unexcelled corrosion resistance	LAMPBLACK, PHTHALOCYANINE BLUE, CHROME YELLOW } for color retention and durability
IRON OXIDE—for color and adhesion between primer and finish.	TITANIUM DIOXIDE—for unexcelled weathering characteristics
ALKYD AND MELAMINE RESIN —for unexcelled durability	ALKYD AND MELAMINE—for unexcelled durability
SOLVENTS — for applying film in a continuous smooth coat that best combats weather.	SOLVENTS—for applying film in a continuous smooth coat

Moloseal protects Moloney HiperCore Transformers from the ravages of weather. It combats a high temperature at the interface of the film and the metal and at the same time combats the low temperature of the surrounding air. It prevents a moisture content at the interface of metal and paint film and resists ice or water layer on the film exposed to the weather. It is highly impervious to the destructive rays of the sun and will not lose its effectiveness due to peeling and cracking.

MEDS-20

MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Load Tap Changing Transformers • Regulating Transformers Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers • Subway Transformers • Industrial Dry Type Transformers • Capacitors • Magnetic Components For Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

THE BEST PAINT...
Moloney
Inhibitrol
ELECTRIC

Kitchen With 86.8 kw of Cooking Equipment Shows What Can Happen When . . .

Wiring Allowances Sell Commercial Cooking

SALES
Commercial

By helping buyer with his wiring costs, Sacramento MUD upped its cooking load 120% in area where gas is highly competitive

DAVID J. MORKEN, Commercial Service Engineer, Sacramento Municipal Utility District, Sacramento, California

Faced with selling commercial electric cooking in an area where low-cost gas is popular, Sacramento Municipal Utility District has found an unusually effective weapon: Wiring allowances.

In fact, they proved so effective during a three-month campaign that SMUD wound up with its commercial cooking load a full 120% ahead of the previous year.

How It Worked

The allowance gave each prospect $22 for each kw of equipment installed. Three months were allowed after the promotion ended in which he could complete his installation and still comply with terms of the promotion.

To get the allowance, food service operators had to meet these requirements:

- Equipment had to replace gas, not item for item, but some gas equipment had to be removed and any amount of electric equipment installed.
- Their establishments had to be open to the general public. This excluded private clubs, government cafeterias, hospitals, in-plant feeding, and schools.
- Equipment installed could be inspected and the installation used for publicity by SMUD.

A power contract, based on kw of new connected load, was drawn between the food service operator and the utility. Binding for five years, it did not affect the customer's regular bill but provided minimum-bill protection for SMUD's investment. It also stipulated that SMUD, being publicly owned, was to retain title to the wiring installed for five years. In this time net revenue will have paid for the wiring, and it then will revert to the customer.

After the promotion was set, commercial sales representatives quickly contacted restaurant owners and managers. Dealers, distributors, and manufacturers were organized. Because SMUD does not merchandise, their cooperation was important to the campaign's success.

Commercial electric equipment was displayed in SMUD's show windows and lobby using the theme, "Of Course it's Electric." Three direct mail pieces were sent. The last was a telegram which warned that only a few days remained to take advantage of the offer.

Problems Encountered

As with any promotion, there were some problems. Principal ones: The five-year contract and the short period of promotion. Restaurants are not remodeled on a few weeks notice. Major sales were made in places where the owner already was planning some remodeling. SMUD feels that future wiring allowance promotions should run for at least one year and that the power contract be shortened or eliminated.

(*More S & S on page* 141)

New ideas to keep you ahead of the "power curve"

The utility industry and the market it serves just keep right on growing! Productive energy, to help more people do more jobs at less cost, finds ever-expanding applications. One thing is sure . . . there is a big appetite that will demand twice as much power in the next 10 years.

On the next 11 pages, C. V. Roseberry, Manager of Electric Utility and Transportation Sales, and experts from Westinghouse Apparatus Divisions report the latest progress being made in equipment, materials and techniques to help you stay ahead of this load growth.

YOU CAN BE SURE...IF IT'S

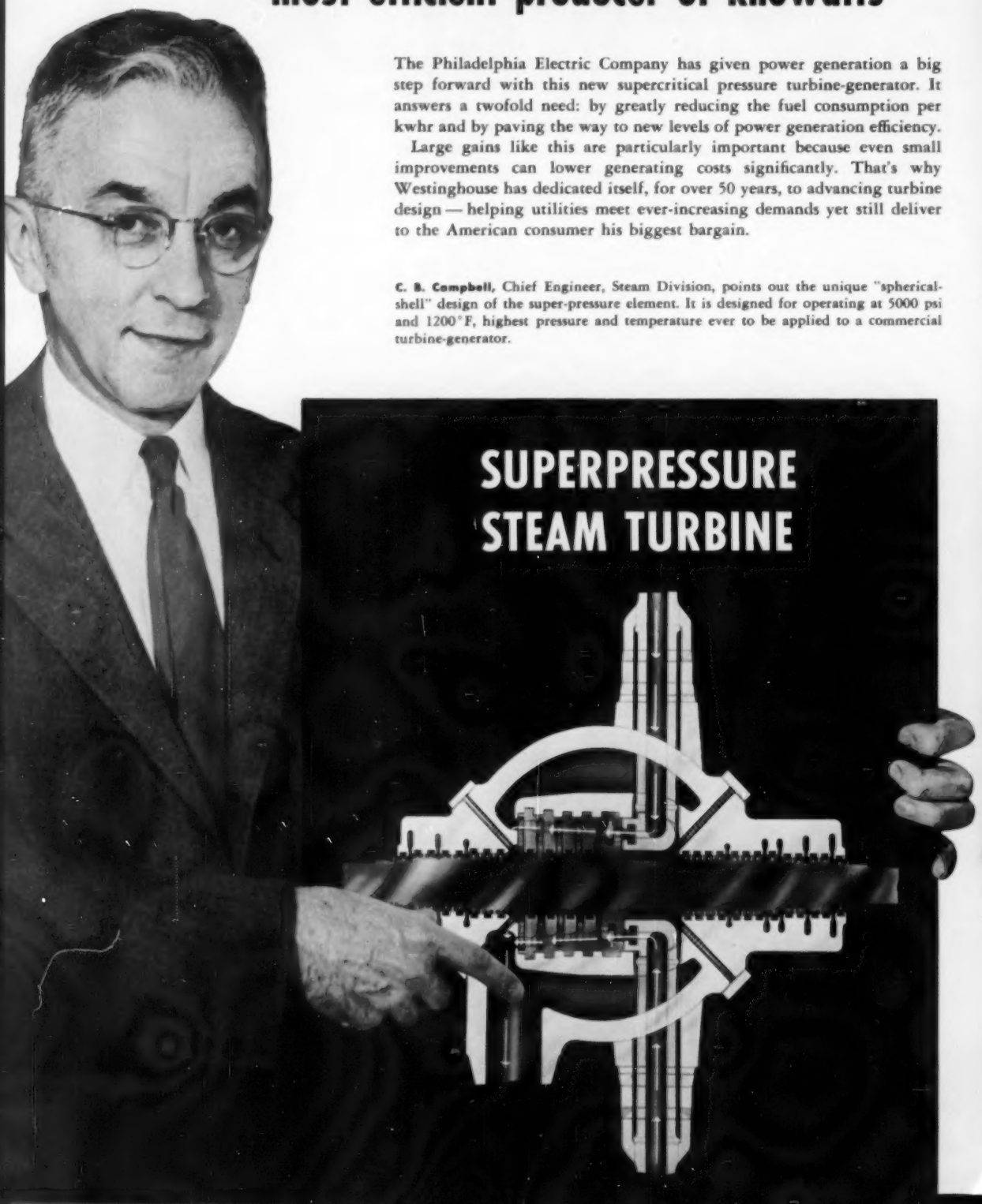
Westinghouse

STEAM TURBINES:

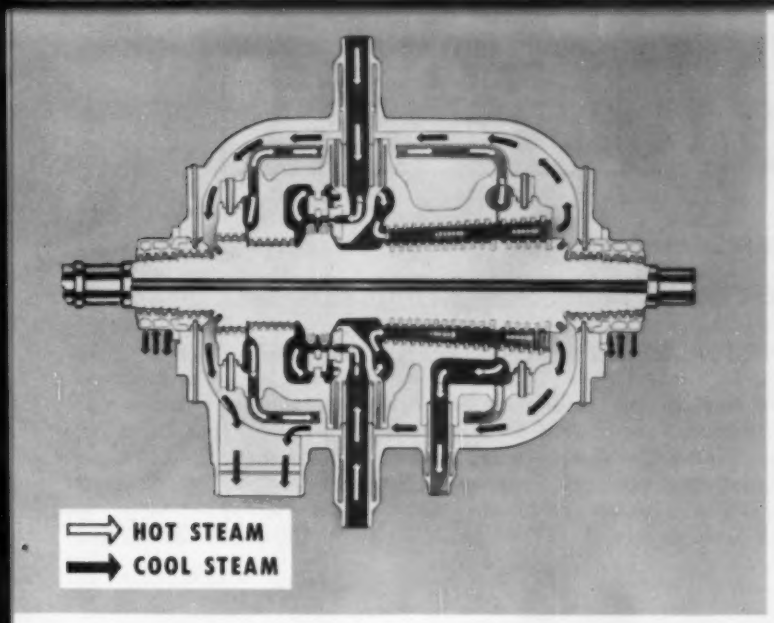
5000 psi, 1200°F design—world's most efficient producer of kilowatts

The Philadelphia Electric Company has given power generation a big step forward with this new supercritical pressure turbine-generator. It answers a twofold need: by greatly reducing the fuel consumption per kwhr and by paving the way to new levels of power generation efficiency.

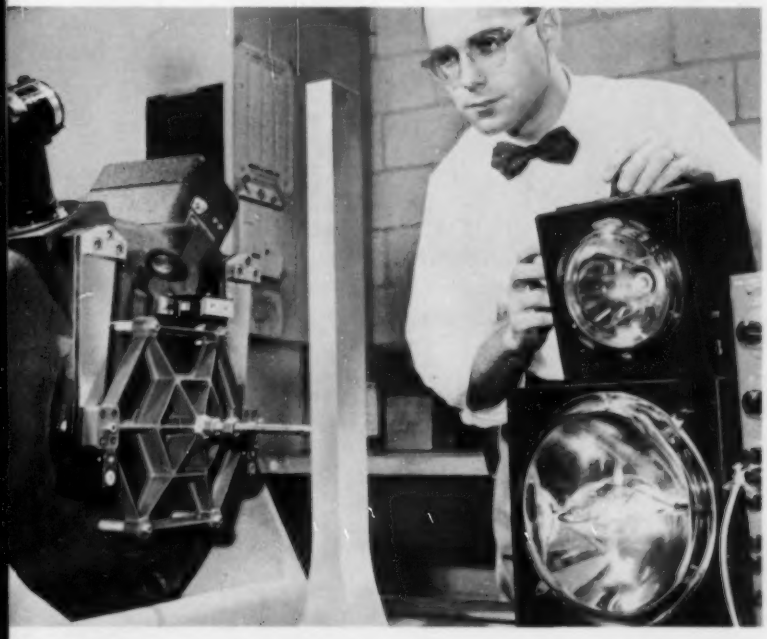
Large gains like this are particularly important because even small improvements can lower generating costs significantly. That's why Westinghouse has dedicated itself, for over 50 years, to advancing turbine design — helping utilities meet ever-increasing demands yet still deliver to the American consumer his biggest bargain.



C. B. Campbell, Chief Engineer, Steam Division, points out the unique "spherical-shell" design of the super-pressure element. It is designed for operating at 5000 psi and 1200°F, highest pressure and temperature ever to be applied to a commercial turbine-generator.



Mass-flow cooling is a relatively new Westinghouse technique to increase reliability and efficiency of turbine-generators. Cooled, partially expanded steam is recirculated to cool vital areas, permits quick adjustment to changes in load, starting and stopping. Advancements like this, proved on conventional turbines, are being combined to make superpressure units completely practical today.



Product improvement through broad and minute development gives you higher ratings and lower cost kilowatts. Vibration stress analysis, for example, determines vibration patterns and damping characteristics of blade materials and designs — extremely important in large turbines. These studies assure successful application of new alloys for higher pressures and temperatures.

YOU CAN BE SURE...IF IT'S
Westinghouse

THE FUTURE

C. V. Roseberry says: *"Solutions* to utility problems are one of the biggest 'products' we have to sell. In fact, we take great pride in knowing your needs and designing equipment which can help you operate at higher efficiencies and keep kilowatt costs traditionally low. These pages show just some of our current work—typical of the activity taking place in every division."

T. Fort, Vice President, points out: "The problem of keeping pace with normal load growth is a big one. It becomes even more important when we begin to realize that our estimates have actually been *conservative*! The symbol of the Third Future Power Market Forum appearing throughout this advertisement dramatizes the spectacular increase predicted. Aluminum and chemicals, air conditioning and automation make the trend clear. The need for future power —now estimated at even *more* than the usual doubling every 10 years—is far in excess of present capacity. Helping you meet this demand is our job . . . with new ideas and equipment to do it at continued economical levels."

"In the expanding horizon of power generation development, two new prime-mover types stand out as promising answers for the future."

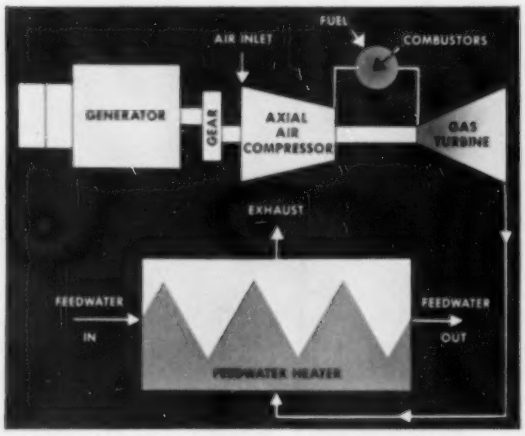
GAS TURBINES:

Economy, reliability bring new power generator into its own

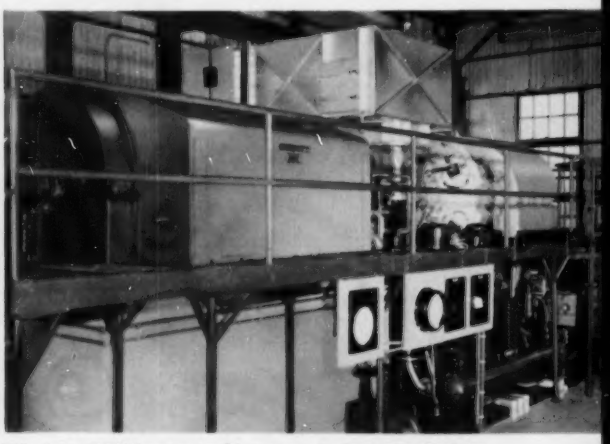
Three factors draw attention to Westinghouse gas turbines as specialized power plants for meeting future loads:

(1) The over-all simplicity and economy of installation
(2) Demonstrated reliability, important for base-load use
(3) Extra economy and efficiency possible through use of exhaust heat

D. R. Jenkins, Land Gas-Turbine Sales Manager, studies a model of the new 15,000-kw gas turbine for power generation—typical of progress being made. This turbine is now being assembled. It is a compound open-cycle type, with intercooling and regeneration, providing efficiency equal to any of today's prime movers of this rating.



Feedwater heating is one of several ways gas turbines can improve capability and heat rate of older stations. It takes extraction load off steam plant, permits running main turbine at full rating. Exhaust can also be used in waste-heat boiler or as combustion air for fuel-fired boilers.



This is a 3000-kw gas-turbine power plant installed for base-load operation. It is extremely compact, requires very little cooling water, burns natural gases directly. Minimum building, light foundation and packaged subassemblies contribute to low installed cost and proved easy maintenance.

These gas-turbine power plants presently range from 1250 kw to 15,000 kw. They can handle base-load, peak, stand-by, end-of-line, emergency and mobile applications. The Man With The Facts, your Westinghouse sales engineer, will help you put this new power generator to work. A special survey, by experienced gas-turbine specialists, can open the way for sound low-cost ways to meet growing loads.

ATOMIC POWER STATIONS:

Turbine design important key to efficient nuclear power

The advanced thinking of Steam Division engineers has paid off handsomely with the *first* turbine designed specifically for use with atomic power plants.

The problems? Low pressure and temperature mean low available energy. The result: exceptionally high volume, high steam flow per kilowatt. Nuclear-produced steam is "wet"—can play havoc with a conventional turbine. Westinghouse applied such a wide range of turbine experience that these problems are soundly resolved. Special blading, steam chest, flow distribution and "bleed-off" are designed to wring the maximum amount of energy from the steam, protect the turbine from water erosion and extract the moisture in the most efficient manner. Modern efficiency standards and modern ratings are achieved.

This is a completely *new* turbine, ready *now* for the specific conditions of an atomic power station. This head start can help you explore the dynamic new opportunities to make atomic power more practical and economical.

YOU CAN BE SURE...IF IT'S Westinghouse

W. C. Rowland (right), Vice President and Manager of the Steam Division, and J. R. Carlson, Engineering Manager, look at the special turbine developed for the unique conditions found in atomic power stations. Design principles have been clearly established and are ready to be applied to large compound machines for future atomic power plants.

"Below, **J. W. Batchelor**, Manager, Turbine Generator Design Engineering, shows how this division helps keep ahead of the power curve."

GENERATORS:

Inner-cooling and Thermalastic insulation double ratings . . deliver extra reliability

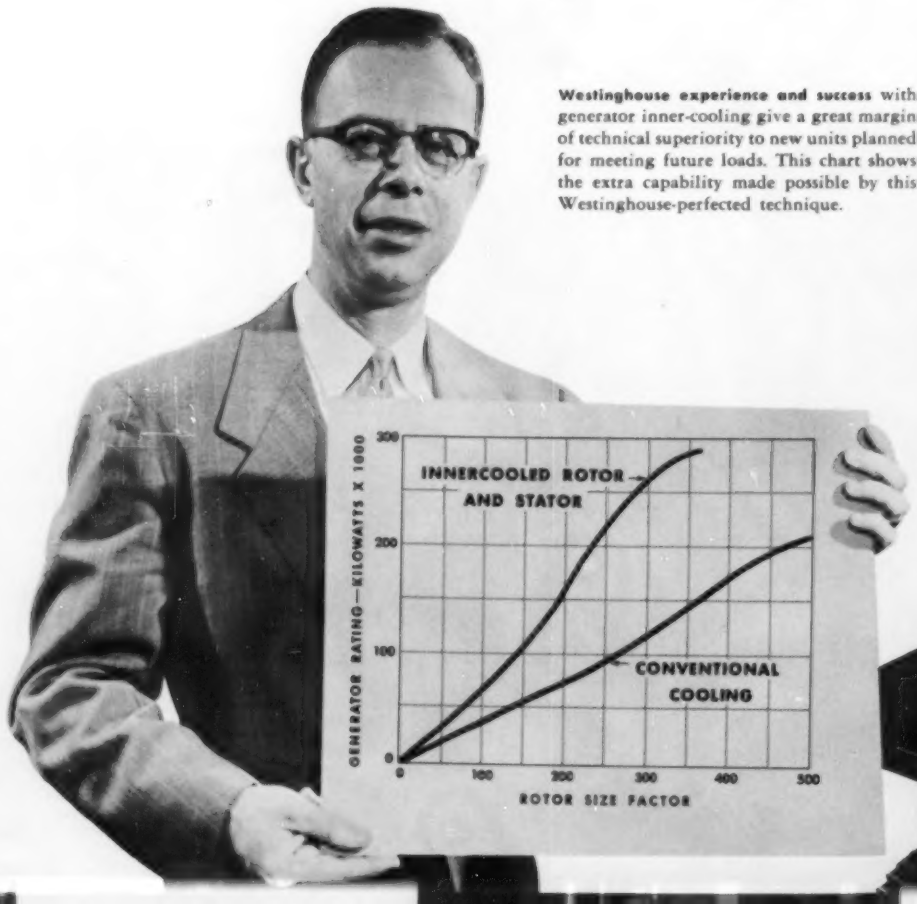
Economies of large turbine-generator units would soon be lost without two big advances: Generator inner-cooling and Thermalastic® insulation.

Inner-cooling has made it possible to blow hydrogen through the *inside* of rotor and stator conductors in intimate contact with the copper where heat is generated. It has become the most simple and effective cooling method ever devised. Already proved in extensive service, inner-cooling has doubled single-shaft ratings over conventionally cooled units and greatly reduced size and weight.

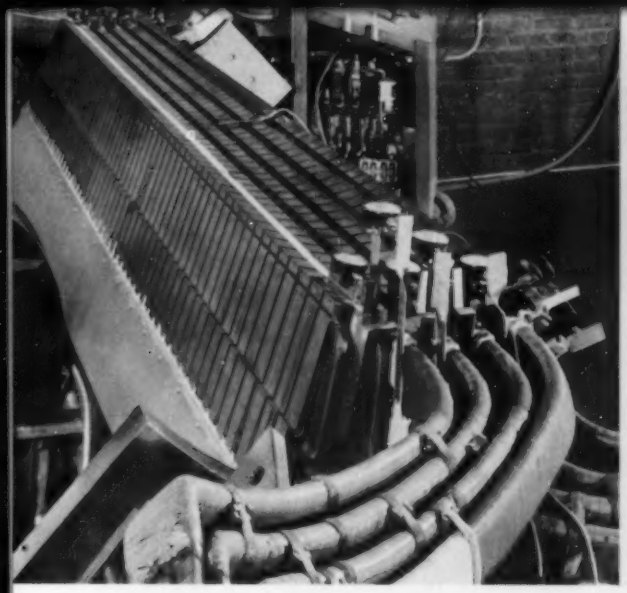
Thermalastic insulation is the other big step. Known as the "insulation with a memory", it has a unique molecular structure which permits expansion and contraction of the windings, without deformation or injury for the life of the machine. This gives that extra assurance of reliability for large turbine-generator operation and the extra margin of performance important to utility costs.

These are important keys to greater generating capability, paving the way for the ratings needed in meeting future load growth economically.

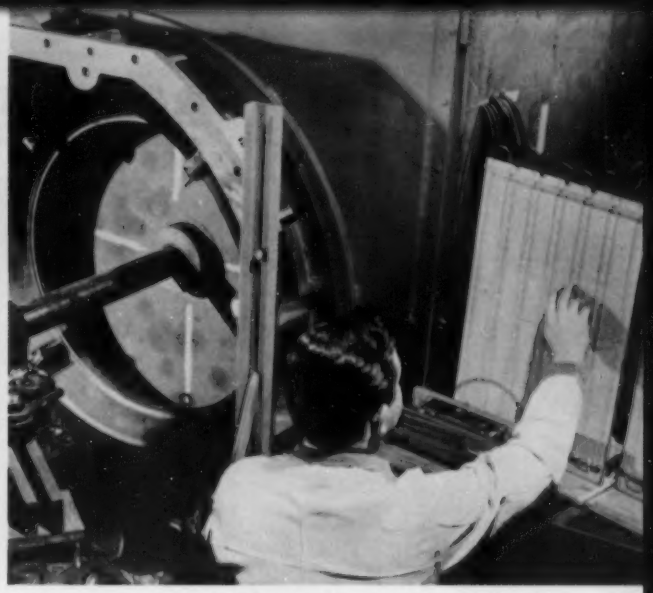
YOU CAN BE **SURE**...IF IT'S Westinghouse



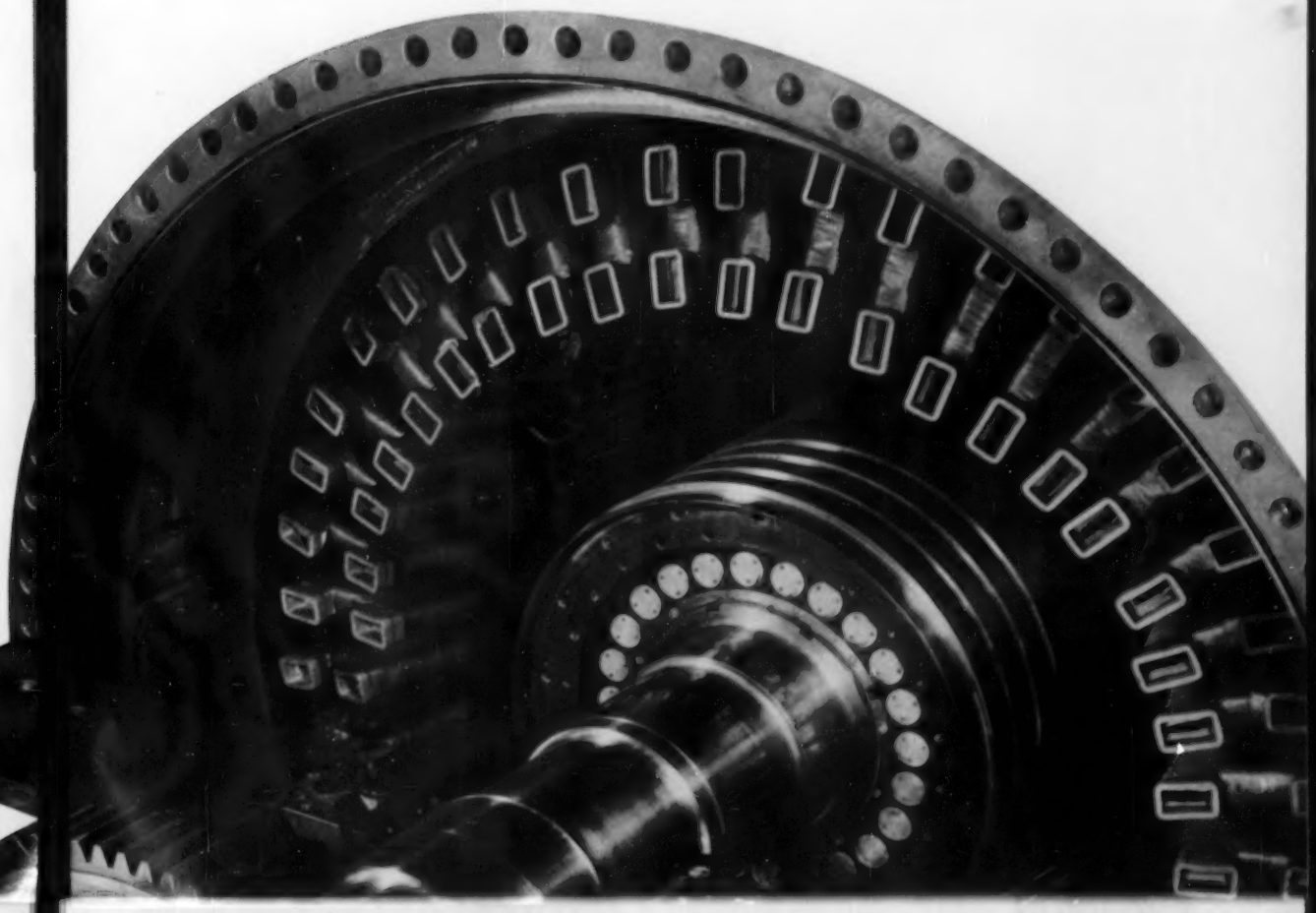
Westinghouse experience and success with generator inner-cooling give a great margin of technical superiority to new units planned for meeting future loads. This chart shows the extra capability made possible by this Westinghouse-perfected technique.

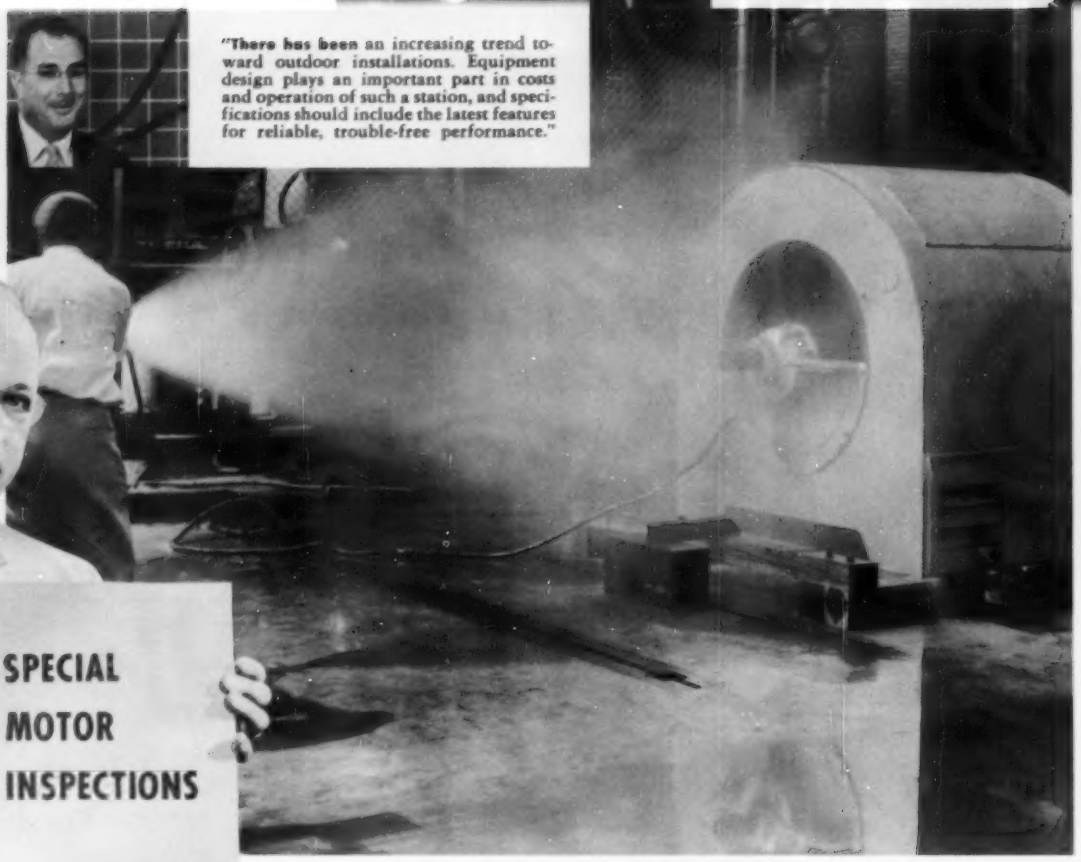


Thermalastic insulation was first proved on these torture racks. Similar tests showed fundamental weaknesses in conventional insulations, gave a sound basis for developing Thermalastic insulation. It can stand severe cyclic distortion, and has dielectric properties far superior to other types of insulation.



Generator inner-cooling is the result of intense development in all phases of blower designs and cooling systems. This special test rig accurately measures volume and pressure of flow, shows how refinements in coolant flow and pressures — ready to be applied as required — promise a sound and economical method to meet increasing loads.




"There has been an increasing trend toward outdoor installations. Equipment design plays an important part in costs and operation of such a station, and specifications should include the latest features for reliable, trouble-free performance."
SPECIAL
MOTOR
INSPECTIONS

Carl F. Hagadorn, Large Motor Section, with a list of the *26* special checks given to all powerhouse motors. In the background . . . a dramatic water spray demonstration.

POWERHOUSE MOTORS:

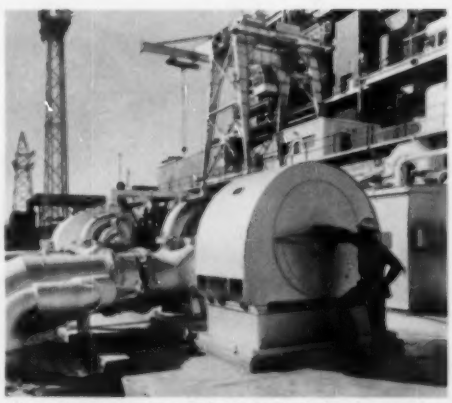
Thermalastic insulation, plus 26 special checks, boosts motor dependability

Westinghouse powerhouse motors meet the need for bigger ratings and 24-hour duty with two very special extras: Thermalastic insulation and rigidly controlled design and quality standards.

For outdoor use, especially, Thermalastic makes the *big* difference. It is the one insulation which can withstand water, heat and dust and still provide designed protection. As the most important single component contributing to motor dependability, it gives every Westinghouse Thermalastic-insulated powerhouse motor a much greater margin of reliable, trouble-free operation.

The *26* special checks are another very important extra. Throughout manufacture, these inspection procedures, *over and above* standard specifications, are performed by experienced technicians to insure that the motor is qualified to operate under every required condition.

Outdoor or indoor, these features will give you dependable operation which lowers operating costs, keeps stations on the line as they meet increasing demands for power.



These Westinghouse 800-hp, 14-pole induction motors, which drive circulating water pumps at an outdoor station, have given highly satisfactory service since their installation three years ago. Since that time, many improvements have made this type of motor even more reliable.

SWITCHGEAR:

These five features provide indoor reliability under outdoor conditions

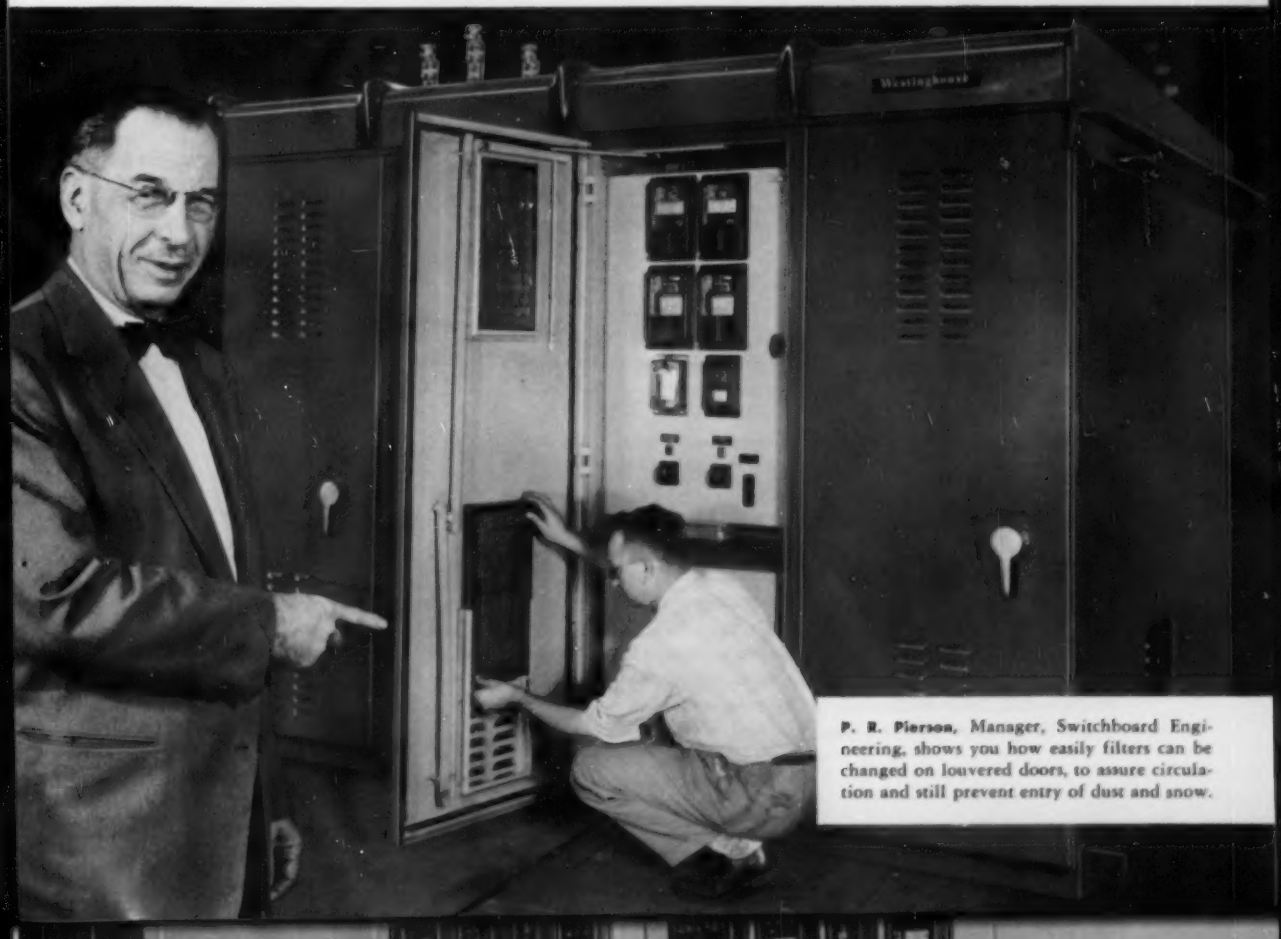
Westinghouse outdoor metal-clad switchgear gives you maximum reliability demanded by today's larger and more complex station auxiliary services . . . under all-year, outdoor conditions.

These five weather-protection features assure indoor dependability . . . outdoors:

- Sheet steel outer enclosure and interior barriers provide complete weatherproofing plus compartmental protection. Replaceable filters allow ventilation, yet prevent entry of snow and dust.
- Bonderizing, multi-coat painting plus all-weather undersurface coating, protects against rust and corrosion thus adding years to housing life.
- Self-supporting, jig-welded, unit-type construction provides strength for long-lasting protection against damage to the circuit breakers and other vital interior parts.
- New "REDARTA" insulation is used throughout Westinghouse metal-clad switchgear. This exclusive insulation is superior in every way — including flame-retarding ability — to any fibrous insulation ever developed.
- Ceramic arc chute construction is nonhygroscopic and is highly resistant to heat shock.

These features, plus ease of inspection and maintenance afforded by horizontal drawout construction, make this Westinghouse equipment the ideal answer to out-door switchgear problems.

YOU CAN BE SURE...IF IT'S Westinghouse



P. R. Pierson, Manager, Switchboard Engineering, shows you how easily filters can be changed on louvered doors, to assure circulation and still prevent entry of dust and snow.

"Trend to larger blocks of power creates other demands: closer system control, heavier loading, more system interconnection, and foolproof protection. New Westinghouse developments are increasing the utility of microwave and power-line carrier, and opening opportunities for more automatic, centralized control."

Westinghouse microwave and carrier are built on this "building block" principle—coordinated, basic units afford maximum flexibility of installation, and provide for subsequent alteration and expansion to aid system growth.

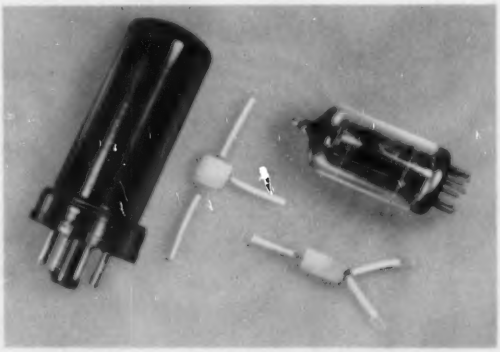
MICROWAVE AND POWER LINE CARRIER:

Self-contained channels boost reliability of relaying . . centralized control

For utmost microwave reliability, each of the channels is strictly independent. If one channel develops a fault, all others continue without interruption. That's because the Westinghouse FJ multiplex panels are self-contained. Each channel is crystal controlled. The result: stabilized coordination over wide ranges of input voltages, temperature and other variables. Only Westinghouse microwave offers such extensive assurance of reliability.

New channelizing equipment will make microwave relaying more desirable than ever before. Specifically designed to fulfill highest reliability standards of electric utilities, it will bring new flexibility to system protection.

Westinghouse will supply complete, single-source responsibility for all your microwave and carrier needs — from survey through installation — for the latest in primary and end-use equipment.



This dramatic comparison shows great physical difference between transistors and vacuum tubes. Equipment can be made surprisingly compact, yet easily accessible. Experimental transistorized assemblies are being field tested now. Progress to date indicates that transistors will eventually replace vacuum tubes in communication and control equipment—providing higher reliability and lower maintenance.

YOU CAN BE **SURE**...IF IT'S

W. D. Connolly, Westinghouse Relay Sales Engineer, points to the Westinghouse COV relay which contributes to greater system stability.

GENERATOR PROTECTION RELAYS:

COV relay senses faults, gives automatic back-up protection

Westinghouse COV relays assure generator back-up protection at all times. Coordination with other relays is assured by the availability of elements with various operating characteristics. The COV relay uses voltage to control the operation of overcurrent elements. This makes it sensitive to faults only, undesirable tripping due to overloads or system swings is eliminated.

The *exclusive feature* is this: Each setting of current and voltage elements is independent, easy to adjust, eliminates need for involved calculations. All of these characteristics make the Westinghouse COV relay an advantageous piece of equipment for protecting your investment — one more example of how new products and ideas are being pioneered to answer utility problems.

Westinghouse

"Here is how the use of plastic models for vibration analysis is applied to a generator frame setup . . . one of the *new ideas to help keep you ahead of the power curve.*"

Designing to eliminate vibration through plastic model analysis

As system planners require ever larger and more complex equipment, new problems arise for apparatus designers. In the case of large rotating machines, for instance, exact vibration characteristics must be known to assure proper operation *before* construction begins.

To do this, Westinghouse scientists, using plastic models, have developed a new technique that is far simpler and much more exact than mathematical computation—even by calculating machines.

This method extends the use of models beyond purely static tests involving loads and deflections. Alternating forces are applied to the model of the prototype structure and the resulting resonance curve can be interpreted by resolving the difference between model and prototype materials. This allows the designer to adjust the vibration peaks for the actual equipment safely away from known excitation frequencies.

Vibration analysis through plastic models is another example of the research and design investigation facilities that enable Westinghouse to produce the new ideas and equipment to help you stay ahead of the power curve.

Call ***The Man With The Facts . . .***

For complete facts on the equipment discussed on the preceding ten pages, call The Man With The Facts — your Westinghouse sales engineer . . . or contact him through Westinghouse Electric Corporation, 3 Gateway Center, Pittsburgh 30, Pa.

YOU CAN BE **SURE**...IF IT'S

Westinghouse

CP-1030

Heat Pumps Save

Trial units in Pacific Northwest undercut costs of other fuels by as much as 35%

Heat pumps are saving up to 35% in fuel costs in several Pacific Northwest installations being tested by Washington Water Power Co.

A. B. Martin, WWP consulting engineer, told a recent Northwest Electric Light & Power Association meeting in Spokane that heat pump operating costs in the tests ran below what it would have cost with oil at Northwest prices. He said the heat pumps were operated at a cost from 74¢ to 95¢ per 1,000,000 Btu, while the oil required to produce the equivalent amount of heat would have cost $1.30.

Two types of heat pumps were used in the tests, the conventional air-to-air and a model which uses air from a well, eight to 14 ft deep, as its heat source. Martin said experience with this latter type has shown it to be practical for a large portion of WWP's service area where there is a good gravel base.

For supplementary heat, oil as well as electric resistance heating was used. He said the oil not only proved more economical, but it did away with load factor problems encountered when electricity was used.

A non-electric heat source, such as an oil furnace would be more satisfactory, he maintained. "We have met some resistance to this marriage with an oil furnace, but we think it is a practical answer to the problem."

Appliance Sales Remain High, Say Makers

That appliance sales have been good is given support by mid-year sales figures now being released by manufacturers. Some samples:

- General Electric Co's small appliances set a new six-month record with sales 27% ahead of same period last year;
- Kelvinator Division of American Motors Corp says factory sales of all appliances for quarter just ended are 69% greater than a year ago;
- American Home Laundry Manufacturers Association reports member companies' factory sales of washers, ironers and dryers are running 34% above last year;
- Chrysler Corp's Airtemp Division says it sold 101% more waterless air conditioners in first eight months of fiscal 1955 than it did in the same period of 1954.
- Westinghouse Electric Corp, with major appliance sales up 25%, says it had best first six months in '55 of any similar period in its history.

To add optimism to the months ahead, Don G. Mitchell, chairman and president of Sylvania Electric Products Inc, predicted the national economy will continue to strengthen in year's second half and will lose none of its "forward motion" in 1956.

Long-range sales in the lighting field also are showing healthy gains.

Sales of Westinghouse incandescent and fluorescent lamps have increased some 27% during the last five years, reports F. M. Sloan, general manager of the company's lamp division.

S & S SHORTS

Appalachian Wins Display Contest

Appalachian Electric Power Co has been named winner of the fifth annual window display contest sponsored by Electric Housewares Section of National Electrical Manufacturers Association. Display featured bride mannequin and huge bridal wreath all tied in with campaign slogan, "Electric Housewares for Modern Living—and for Modern Giving."

Sells Ranges With Cookware

New Jersey Power & Light Co provided its dealers with $35 sets of aluminum cooking ware for use as premiums in a six-week electric range campaign just closed. The company contributed $5 towards the cost, with most distributors putting in a like amount. Result: The company sold 598 ranges to lift sales for the first six months 10.6% above last year.

Chrysler Corp Airtemp Division photo

Cool Photo Lab Improves Print Quality

Air conditioning not only cools employees but also aids quality control in this laboratory of Commercial Photos, Inc, Dayton, Ohio. "Negatives are kept dust-free, and processing chemicals are maintained at even temperature since we installed our window-type air conditioner," says Elwood Hiester, Commercial's president. "This is extremely important to our operation and makes it possible for us, in far less time, to turn out more and finer prints of uniform quality." Another benefit cited by Hiester: Unit's exhaust draws annoying chemical odors from the room.

NEW EQUIPMENT

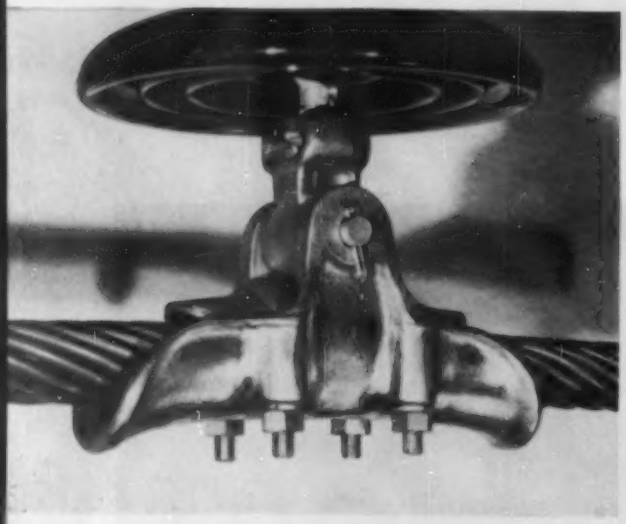
Hydraulic Pole Setter

A hydraulic, telescopic pole setting attachment is available for a line of earth boring machines. The attachment is said to increase the versatility of the boom without extending its length.

Two hydraulic cylinders with a 3-in. diam and a 42-in. stroke are placed below the boom sheave and coupled to the earth boring machine's hydraulic system.

The earth boring machine uses 10 to 20-in. augers and digs holes up to 9½ ft deep.

Wyoming Valley Equipment Co, 1089 Wyoming Ave. Forty Fort, Pa.



Suspension Clamp

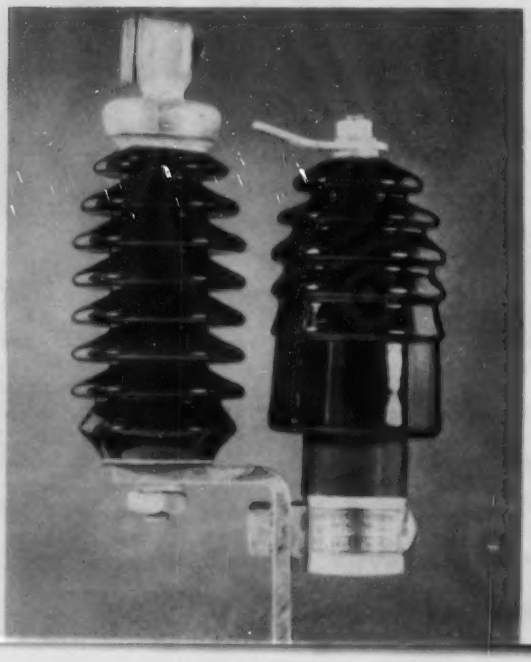
Bottom curvature of aluminum suspension clamp is said to permit turning a wide range of angles on suspension pull-off. A flare on the side of the groove at the clamp mouth provides the proper approach angle of conductor to clamp regardless of tension, sag or magnitude of angle turned on pull-off, says the manufacturer.

Other design features of the Type "HAS" clamp are: Elimination of clevis pin rotation, use of a cotter key with enough spring to prevent movement in the key hole due to conductor vibration, a shunt from conductor to insulator pin to provide a continuous circuit for insulator charging current thus preventing radio and TV interference, and short clevis ears to reduce wear on connecting parts and reduce vibration damping by the clamp.

The "HAS" clamp is available in various sizes covering a conductor-clamping range from 0.40 to 2.52-in. diam, with ultimate strengths ranging from 17,000 to 30,000 lb.

Anderson Brass Works, Inc, 701 N. 41st St, Birmingham, Ala.

Lightning Arrester



Expulsion type lightning arrester with a spiral grooved expulsion chamber is claimed to offer the following features: (1) Effectively controlled discharge arc throughout entire operating cycle; (2) low sparkover, providing a minimum of stress on protected equipment; (3) multiple arcing paths to minimize fiber erosion and extend arrester life; and (4) high strength construction and good venting to provide high lightning surge capacity.

In addition, the arrester is said to eliminate arrester lockout, leakage and radio noise since it is both mechanically and electrically isolated from live line parts.

The units are available in 9 and 18-kv ratings and carry a 5-year guarantee. They are available in conversion and crossarm assemblies and will be provided for protected type transformers. Ask for Bulletin No. 6000.

RT&E Co, 1900 E. North St, Waukesha, Wisc.

(*More New Equipment on page* 144)

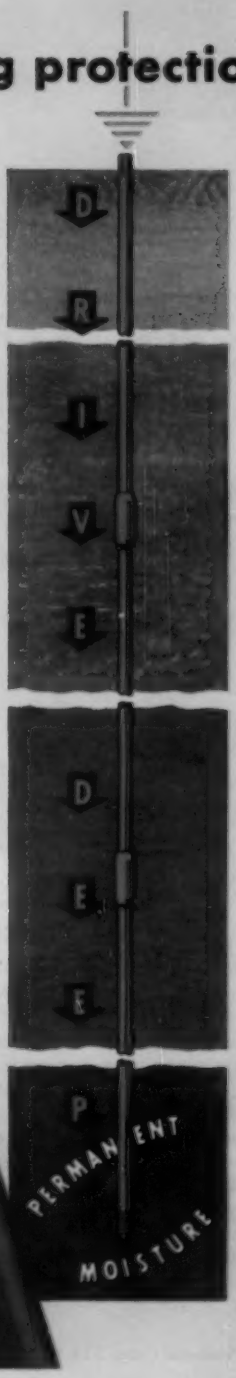
Permanent grounding protection—

simple as

a Drive deep—16, 24, 32 feet or more—to low-resistance soils.

b Determine how deep to drive by measuring the resistance of each section, allowing for seasonal variation.

c The result—you get top performance from protective equipment—*permanent grounding protection.*



with

Copperweld TRADE MARK

sectional ground rods

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION, Glassport, Pa.
For Export, COPPERWELD STEEL INTERNATIONAL COMPANY, New York

1955--our 40th year

Self-Propelled Shovel-Crane

Self-propelled shovel-crane with a ⅜ cu yd, 6 ton capacity is designed for materials handling, construction and industrial applications. The Bantam CR-35 has an outside turning radius of 19½ ft for getting into tight working quarters to handle heavy loads, says the manufacturer. Another feature is two-speed independent travel which allows the operator to work upper deck machinery and travel at the same time.

Attachments include crane, clamshell, dragline, shovel, trench hoe, magnet, grapple, pile driver and backfiller. Illustrations show crane (right) and trench hoe (left).

Schield Bantam Co, Park St, Waverly, Iowa

Induction Regulators

Improved single-phase induction regulators feature stainless steel cover bands, mercury limit switches with enclosed contacts and a cushion-mounted control cabinet.

The easily removable covers provide evenly distributed pressure around a nitrile rubber gasket, says the manufacturer. Limit switches stop operating motor at maximum raise and maximum lower positions while enclosed contacts prevent fouling by foreign material. Cushion mounting is said to eliminate the possibility of vibration being transmitted to control cabinet and assure more accurate regulation.

General Electric Co, 1 River Rd, Schenectady 5, N. Y.

Meter Mountings

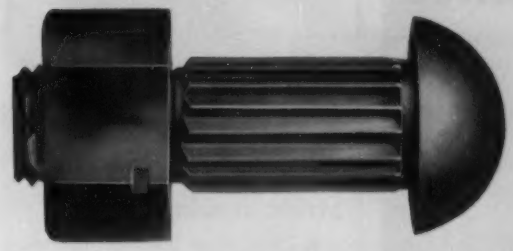
Socket meter mountings are said to permit an installation to be made in about half the time normally required. In addition, they are said to provide continuous service to the customer while meter is being removed or tested.

Ample wiring room is provided and there are no wires behind the meter to cause shorts or grounds. Bus bars back of the porcelain bring the wiring terminals into the lower section of the mounting, thus preventing water or condensation from getting on any wires behind the meter.

The mounting may be used as a single unit or additional mountings may be added at any time without using fittings. This is done by removing the end wall of each mounting and interlocking the units as illustrated. Meter mountings are made of aluminum or Galvannealed steel. Small size single units are also available with or without hubs in the top.

Code Products Corp, 214 Kalos St, Philadelphia 28, Pa.

ON THE WORLD'S TALLEST TOWER



All field connections were made with Galvanized "Structural Rib Bolts" and Galvanized ANCO Lock Nuts having U. S. Standard threads.

WE are proud that the designers of the tallest structure in the world used our products in its fabrication. The fact that this gigantic structure must stand up under tremendous stresses and strains only serves to illustrate the confidence of its designers in the unusual strength and dependability of our product.

Tests show a ⅝" dia. ANCO bolt to be stronger than a ¾" dia. rivet while shear and bearing values are equal to hot driven rivets.

In addition, structural rib bolts with ANCO lock nuts greatly reduce time and labor costs because they require less skill to install. In fact, they are so easy to install that one man with a maul and wrench can replace a forge and riveting team . . . and do a better job, too! Threads cannot be stripped and the locked nut cannot slip. Vibration tends only to tighten an ANCO nut, but if desired the nut can be removed easily with any ordinary wrench

The Structural Rib Bolt and the ANCO Lock Nut is the answer to your fastening problem. GALVANIZED or black ANCO Structural Rib Bolts are used in the erection of all types of towers—Radar, Television, Radio, Hi-Tension, etc. GALVANIZED ANCO Lock Nuts are used on millions of clamps for Transmission Lines.

Write today for samples, complete information and prices.

- **KWTV Tower stands 1572' above the ground, 100' higher than the Empire State Bldg.**
- **Triangular in cross section, it is 12' wide on each side up to the 1420' level from which it tapers to the base of the TV antenna.**
- **Total tower weight: 1,323,392 pounds which includes approximately fifty tons of Galvanized ANCO Structural Rib Bolts and Lock Nuts.**
- **Designed and fabricated by IDECO DIVISION, Dresser-Stacey Company. Erected by Mizell Construction Co. of Ganado, Texas.**

AUTOMATIC NUT COMPANY, INC.

LEBANON - - - PENNSYLVANIA

Locate line faults instantly at ranges 1/2 to 200 miles

Model 124 Line Fault Analyzer

Now you can locate power, telephone or telegraph line faults instantly and accurately under all weather conditions. Sierra Model 124 Analyzer eliminates virtually all lost time, hard work and hazard of finding breaks, shorts, opens or other discontinuities. Operating from a powerhouse, transformer bank, substation or terminal point, it pinpoints faults from ½ to 200 miles away with accuracy of ±1 mile on the 200 mile range.

The Analyzer operates on radar techniques, sending a high amplitude pulse along a conductor and presenting echoes from discontinuities as pips on a radar-type "A" scope. Operation is extremely simple, and distances are read direct in miles. Calibrated sweep ranges of 5, 25, 50 and 100 miles are provided. A sweep delay extends range to 200 miles, or permits line segments as small as five miles to be presented full-screen. A movable distance marker can be ranged from 5 to 100 miles.

Model 124 weighs just 59 pounds; and is completely contained in a weatherproofed carrying case.

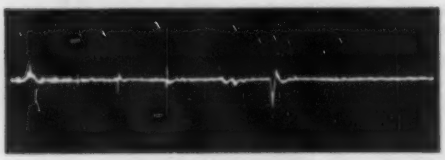


Figure 1

Test on 60 kv line, instrument on 100-mile sweep. Negative pip to right of center indicates line grounded at 60 miles. Other pips are switchyards, transformer bank, substation tap, carrier coupling capacitor, change in line configuration.

For complete details, see your Sierra sales representative or write direct for Bulletin 1028

sierra

Sierra Electronic Corporation
San Carlos, California, U. S. A.
Sales representatives in major cities

Manufacturers of Carrier Frequency Voltmeters, Wave Analyzers, Directional Couplers, Wide-Band RF Transformers, Custom Radio Transmitters

Copyright 1955 Sierra Electronic Corporation

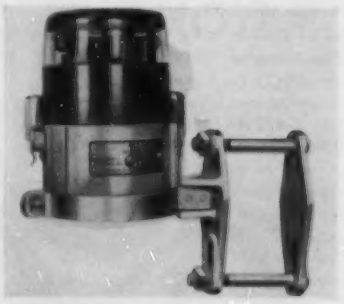
8708

Strain Insulator

A 750-v strain insulator measuring 2¾-in. long by 2-in. diam, is said to have ultimate tensile strengths as high as 14,500 lb, depending on the assemblies. Ultimate puncture strength is in excess of 20 kv.

The 2-in. diam of this tapered insulator narrows down to 1⅝ in. thus providing extra clearance for collectors as well as use of smaller angles and closer conductor spacings, says the manufacturer. In addition, the insulator design is said to provide a greater leakage distance to reduce chances of contamination.

Insulator is molded of phenolic around a high strength steel reinforcement assembly. A complete line of insulators with ½-in. tapping is available with a variety of strain hardware. **Electric Service Mfg Co, 17th & Cambria Sts, Philadelphia, Pa.**



Photoelectric Controls

Redesigned photoelectric relay controls now use one amplifier tube instead of two. The long-life single tube is said to extend normal servicing periods by 2½ to 3½ times.

Series T3000 control is primarily designed for direct load applications, however, it can also be used for remote control applications. It is installed in a standard watt-hour meter

ANOTHER EXAMPLE OF Cope EFFICIENCY...

COPE 70,000 SERIES CABLE TROUGH WITH THE BUILT-IN COUPLER

now available in 12′ length

33% fewer connections

The new Cope 70,000 Series Cable Trough with the built-in Coupler is now available in 8, 10, and *12 foot lengths,* and affords you 80% SAVINGS in assembly time, PLUS 33% FEWER CONNECTIONS.

These features alone mean real savings for you, in time and money.

*PATENT PENDING

Cope

T. J. COPE, INC.

711 SOUTH 50th ST., PHILADELPHIA 43, PA.

NEW, IMPROVED TYPE screw anchor expanders

quickly set anchors in masonry of any thickness, holes in varying depth

Now, with the GREENLEE Screw Anchor Expander you can rapidly and *securely* set lead screw anchors *flush* with the surface of masonry . . . *regardless of its thickness . . . regardless of hole depth.* Eliminates all guesswork . . . the expander tool positions the anchor *positively* every time. Fast, easy operation. Simply drill hole, screw lead anchor onto expander, insert in hole, then strike the expander head with hammer or mallet. It is the ideal tool for setting anchors to hold meter boxes, lighting fixtures, hangers, and other equipment. Three sizes for the most widely used sizes of screw anchors. Write for descriptive folder.

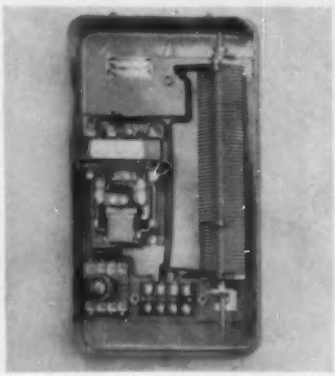
GREENLEE

GREENLEE TOOL CO.
1808 COLUMBIA AVE., ROCKFORD, ILL.

case and is available in 3000-w single-pole, double-throw or 2500-w double-pole, single-throw load contact ratings.

Series T5000 control (illustrated) is designed for remote and direct control applications. It is a self-contained surface mounted unit and can be either pole or crossarm mounted. The T5000 is available with 1000-w single-pole, single-throw load contact rating.

Both series are available for 120-v, 60-cps uses, while the T3000 series is also available for 240-v applications. Components are mounted on a phenolic resin chassis with a withstand voltage of 5 kv rms for the T3000 series and 3.25 kv rms for the T5000. Impulse withstand voltage based on a 1½ x 40 microsecond wave, is 7 kv for the former and 4.2 kv for the latter. Controls are being distributed by Line Material Co, Milwaukee 1, Wisc.
Tabet Mfg Co, Inc, Norfolk, Va.



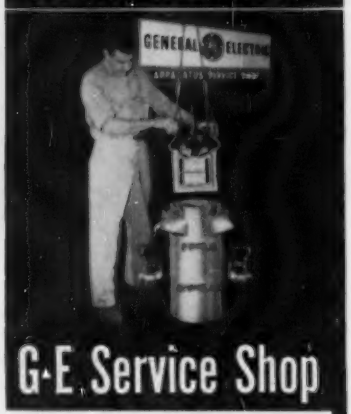
Motor Starter

Step-starting accessory for 3 and 5-hp air conditioners is said to reduce starting currents by about 50%, thus saving the cost of heavier lines and transformers usually required with full-voltage starting.

Starter is mounted as an external unit and consists of a contactor, timing relay and resistor. On starting, the resistor is in series with the motor for about 2 sec, limiting inrush current by 50%. After this interval, the timing relay shorts out the resistor, giving a second increase in current, which diminishes as the motor gains speed.
General Electric Co, 1 River Rd, Schenectady 5, N. Y.

(*More New Equipment on page* 152)

Now: Like new!



Your local G-E Service Shop uses mass-production methods when it rebuilds your old distribution transformers. Result: high-quality work at low cost . . . prompt pickup and delivery . . . and no worries for you. And you get new-unit warranties! There are 31 G-E Service Shops throughout the country—one near you. 431-52

Progress Is Our Most Important Product
GENERAL ELECTRIC

ROEBLING PAPER POWER CABLE WITH TELLURIUM LEAD ALLOY SHEATH

YOU WANT

- *MAXIMUM FATIGUE RESISTANCE;*
- *SUPERIOR STABILITY UNDER HEAT;*
- *HIGH BURSTING STRENGTH;*
- *ABOLITION OF THE NEED FOR FREQUENT STOP JOINTS, REINFORCED LEAD SHEATH, GENEROUS EXPANSION BENDS, LARGE MANHOLES;*
- *LOWEST LONG-TIME CREEP RATE;*
- *THE RELIABILITY ASSURED BY OUR EXCLUSIVE MANUFACTURING, TESTING AND FIELD EXPERIENCE...*

IN SHORT,

YOU WANT

ROEBLING

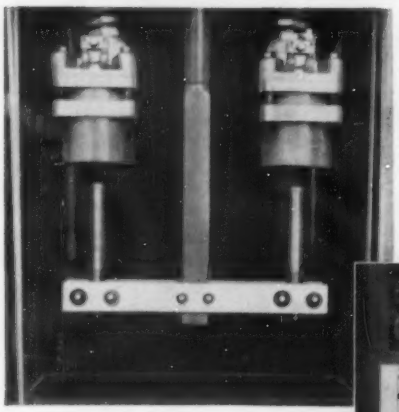
Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13325 LAKEWOOD HEIGHTS BLVD. • DENVER, 4901 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6516 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, TRENTON 2, N. J.

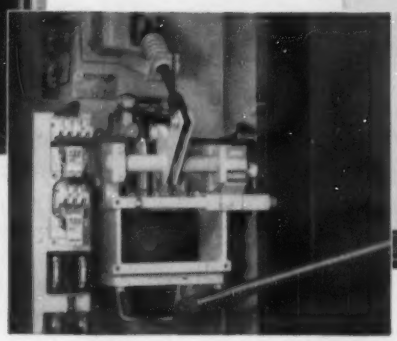
Get the breaker with these

PLUS FEATURES

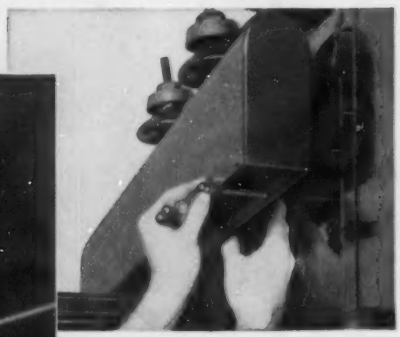
Here's Increased Operating Convenience with High Safety Factor of Tank-Per-Phase Design



TULIP AND BAYONET CONTACTS are self-wiping and self-aligning. Note also, double break per pole design and time-proved *Ruptor* interrupting device are used. Here again, Allis-Chalmers is using the same quality construction as is used on large A-C breakers.



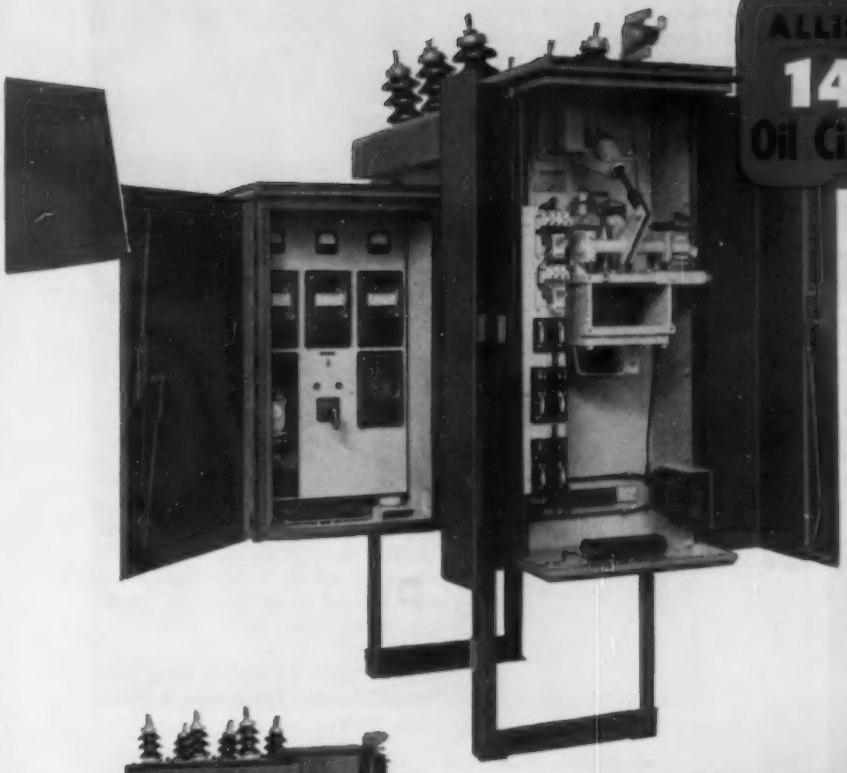
VISIBILITY PLUS. Maintenance closing device is side operated. Man closing breaker can observe contacts and man working on them. In addition, external position indicator easily visible at a distance from front or side. Inside position indicator also provided.



NO BURIED LEADS. Simply remove 3 pins and bottom of fabricated wiring duct to expose bushing current transformer leads. No conduits, pipes, fittings to remove. This is just one more well-thought-out design feature that makes this the outstanding distribution type breaker today.

A-C ALLIS-CHALMERS

ALLIS-



ALLIS-CHALMERS 14.4-Kv Oil Circuit Breakers

NO FALSE OPERATION OF RELAYS. Operate the breaker—slam the door — or let the wind slam it and relays will not operate accidentally. Relay panel is in separate cabinet from operating mechanism and is shock-mounted at 4 points. No hinge wiring either! Separate door in rear of cabinet provides access to back of relays.

ROOMY OPERATOR CABINET — Side hinging of L-shaped doors allows side as well as front access to operator cabinet. Only 7 inches of clearance needed in front of cabinet to open doors. Operator is high speed solenoid type — mechanically and electrically trip-free. Linkage is basically same as used on large A-C breakers.

BREAKER RATINGS (8-Cycle Standard Interrupting Time)

Type	Rated Kv	Rated Amps	INTERRUPTING RATING			Weight of Breaker With Oil (lbs)
			RMS TOTAL AMPERES		Kva	
			At Rated Volts	Maximum Rating		
OZ-15-100	14.4	600	4,000	15,000	100,000	2,350
OZ-15-250	14.4	600	10,000	25,000	250,000	2,370
OZ-15-250	14.4	1200	10,000	25,000	250,000	2,470
OZ-23-250	23	600	6,300	12,000	250,000	2,370

TANK-PER-PHASE construction—as used in large breakers — effectively isolates phases and eliminates possibility of internal phase-to-phase flashover.

GET COMPLETE INFORMATION.
Call your nearby A-C district office, or write
Allis-Chalmers, Milwaukee 1, Wisconsin

Rupter is an Allis-Chalmers trademark. A-4253

CHALMERS

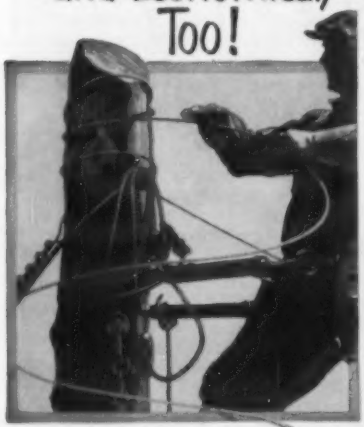
Crapo
GALVANIZED STEEL
STRAND

Strong...
to support pole structures under adverse ice and wind loadings.

Rugged...
to withstand the punishment incurred in construction and service.

Long-Life...
provided by famous Crapo Galvanized heavy, ductile, tightly-bonded zinc coatings.

-and Economical, Too!



● Each size and grade of time-proved Crapo Steel Strand utilizes the superior tensile strength of steel to the fullest advantage. Next time, specify Crapo Steel Strand for guys, messenger and overhead ground wires . . . and save on maintenance!

REINFORCE and PROTECT YOUR CONDUCTORS with Preformed ARMOR RODS

Minimize wear and chafing . . . Absorb and dissipate vibration . . . Protect against arcing and flash-overs . . . Increase holding power against slippage . . . Lessen possibilities of corrosion . . . *Reduce overall maintenance costs.*

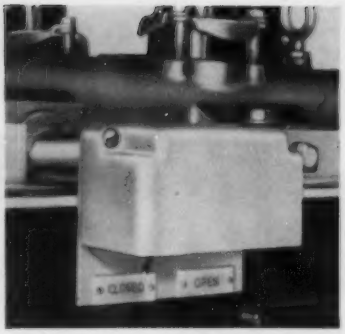
Contact your jobber of Crapo Galvanized Products or write direct for further information!

INDIANA
STEEL & WIRE COMPANY
MUNCIE, INDIANA

Recloser Indicator

Contact position indicator for Kyle Type R recloser gives linemen on the ground visual indication of the position of recloser contacts. A closing lever furnished with the indicator, enables linesmen to manually close main contacts of the Type R recloser in an emergency or when power is off. All parts are supplied in kit form for installation on all Type R reclosers.

The Kyle Type R recloser is a circuit interrupting device that can operate as a recloser or as a relay-controlled circuit interrupter at a load rating of 280 amp. It has a 110-kv BIL and a 2-cycle clearing time.



Line Material Co, Milwaukee 1, Wisc.

Alarm Device

Factory wired protective device gives visible alarm, and can be connected to give audible alarm under abnormal operating conditions. "Safalarm," as it is called, may also be used to actuate circuit breakers or fire fighting equipment. Unit consists of signal lights, alarm relays and a test switch.

Stone Boiler Equipment Corp, Electrical Mfg Div, 186 Powers St, Brooklyn, N. Y.

Voltmeter

Line loading voltmeter determines circuit capacity and adequacy of existing wiring to handle major appliance installations. Model 101 plugs into a standard 115-v outlet and continuously reads line voltage. Built-in front panel switching arrangement permits loading line to 1,000 or 2,000 w to determine voltage drop due to load.

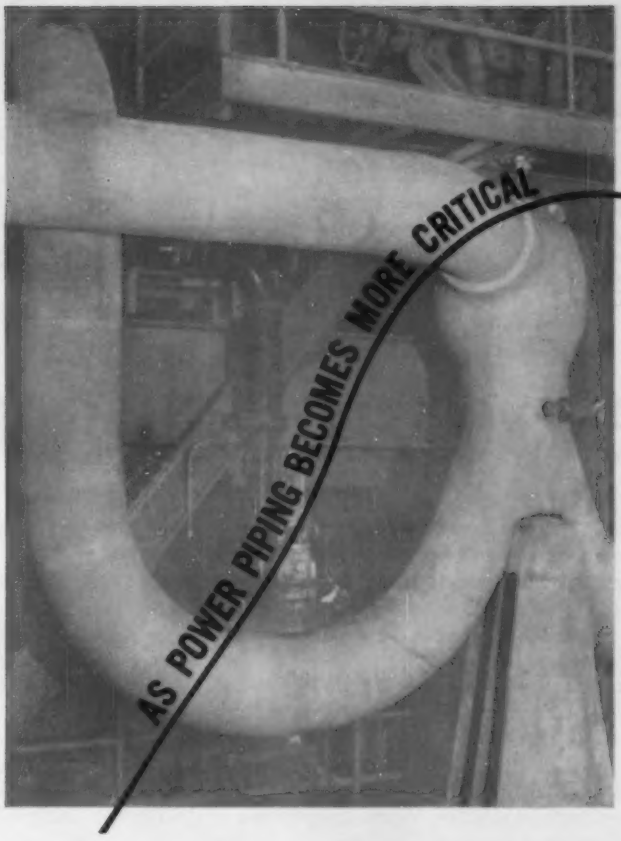
Hickok Electrical Instrument Co, 10572 Dupont Ave, Cleveland 8, Ohio.

Conduit Clamp

A simple tool, called a Race-Klamp, facilitates setting conduit or steel tube in concrete slab floors. It eliminates the problem of properly aligning pipe stubs at uniform heights above floor level and at the same time caps the pipes and holds them in position during pouring operation.

Tool consists of short lengths of conduits attached to one leg of an L-shaped bar. Conduit is cut into two pieces on a 45-deg angle and is fastened to the bar by a bolt running through the conduit axis. Clamping action is internal. As bolt is tightened, the under section of the two-piece conduit is drawn upward and "ex-

(*Continued on page* 156)



M. W. KELLOGG FLEXIBILITY ANALYSIS TECHNIQUES KEEP PACE

Increasingly high pressures and temperatures in central power stations call for increasingly accurate determination of the stresses and reactions of main and reheat piping. Thorough flexibility analysis eliminates the necessity of providing an excessive safety factor by overdesigning. This means shorter pipe runs—which decrease capital investment and increase operating efficiency.

M. W. Kellogg's special stress analysis group employs two basic techniques: (1) The general analytical method, involving development and solution of the requisite simultaneous equations for determining forces and moments in the piping system—calculated either manually or by an electronic computer; and (2) the unique Kellogg Piping Model Tester—which accurately simulates the operation of the most intricate piping systems under temperature.

The stress analysis group, originally formed in 1932, has become an integral function for many of M. W. Kellogg's power piping customers. The group is also available on a consulting basis. A recent booklet describes in detail Kellogg's various techniques for piping flexibility analysis. Copies are available on request.

1. GENERAL ANALYTICAL SOLUTION—MANUALLY OR BY ELECTRONIC COMPUTER

2. THE UNIQUE KELLOGG PIPING MODEL TESTER

FABRICATED PRODUCTS DIVISION
THE M. W. KELLOGG COMPANY, 225 BROADWAY, NEW YORK 7, N. Y.
The Canadian Kellogg Company, Ltd., Toronto • Kellogg International Corporation, London
SUBSIDIARIES OF PULLMAN INCORPORATED

POWER PIPING—THE VITAL LINK

They paced an

This is a story of ten men who traced a trend and rendered a report. Their assignment was to get the facts on what was being done about modernizing electric utilities distribution systems.

As editors, they knew that the residential and rural consumption of electrical energy had doubled in less than six years . . . and that a change in distributing facilities was mandatory. They knew, too, that operators were anxious to exchange ideas that would help fight obsolescence. But the information had to be assembled, analyzed, and made available.

So, for a period of ten months, *Electrical World* ran editorials asking utilities what they were going to do about the future. Then, armed with a detailed and tested 6-page questionnaire, ten editors with from 6 to 47 years' experience . . . and all of them graduate engineers . . . hit the road in 42 states. Thousands of miles of travel resulted in over 300 personal interviews with executives of 107 electric utilities serving 63% of the nation's customers.

The results of the survey, together with pertinent editorial comments, appeared in two issues of *Electrical World*. And after the articles appeared . . . over 19,500 copies of the report were sold to people in the industry.

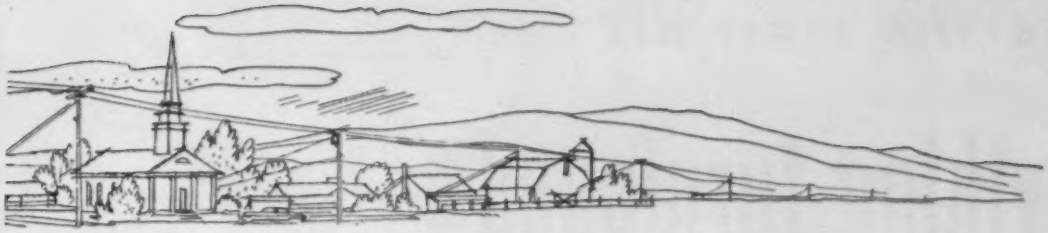
What makes a magazine a leader in its field? There are many factors, but chief among them is the ability and resourcefulness of the editors who give each page its breath of life. McGraw-Hill editors are specialists. They know their fields. They live with the problems of the men—within these fields—who look to them for accurate reporting of news that is vital to their industry.

Their "product" has to be good. Editorial quality must be consistently maintained because every McGraw-Hill publication is *sold* to its subscribers . . . *bought* because of the ability of McGraw-Hill editors to pack each page with information that will help their readers do a more efficient job. That is why every McGraw-Hill publication provides an alert, interested audience for the advertiser's sales messages.

McGRAW-HILL
PUBLISHING COMPANY, INCORPORATED

330 WEST 42nd STREET, NEW YORK 36, N. Y.

OVER A MILLION MEN IN BUSINESS AND INDUSTRY PAY TO READ McGRAW-HILL BUSINESS PUBLICATIONS



industry

***Leonard Olmsted,** Associate Editor of Electrical World, was one of the ten McGraw-Hill editors who conducted field interviews with utility company engineers. In addition, he analyzed and interpreted the survey results.*

Porcelain Products' service mast KIT

Everything furnished

but the house and conduit

for

Ranch type homes

Available Now!—a Service Entrance Mast kit complete to every detail—including roof flashing. Even necessary bolts, nuts, lag screws, and nails. These articles make up the new Porcelain Products' service mast kit that you'll put up and forget. All components of the kit can be *installed by an electrician, with electricians' tools.*

Here is a list of the parts:

- √ 1¼" UL approved Service Entrance Cap
- √ 1¼" to 2" doll Reducer to adapt service cap to conduit
- √ Galvanized Roof Flashing and Storm Collar
- √ Roof Mounting Plate of new and original design
- √ Conduit hanger with 2¼" lag screw attached
- √ Slip-fitting offset reducer with interior grounding device
- √ All necessary bolts, nuts, lag screws and nails
- √ Plus—Porcelain Products famous 2061-C Pipe Mounting house brackets as specified.

Write for details today!

61 years **Porcelain Products, Inc.** PP INC
FINDLAY, OHIO

New Equipment

(*Continued from page* 152)

pands" inside the raceway. Clamps may be connected back-to-back for double rows and may be gauged for panel stubbing.

Clamps and adapters are available for ½, ¾ and 1-in. conduit.

Products Engineering & Mfg Co, Box 16044, Houston, Tex.

Switch & Bus Insulators

Design of switch and bus insulators of the cap and pin type is claimed to provide maximum impact strength, good corrosion resistance, low radio noise level and high insulating qualities. Made of wet-process porcelain, insulators are said to meet or exceed all EEI-NEMA mechanical and electrical standards for their classes.

Insulators are available in 7.5, 15, 34.5 and 69-kv ratings. They are distributed by Line Material Co, Milwaukee 1, Wisc.

Illinois Electric Porcelain Co, 510 N. Pearl St, Macomb, Ill.

Feeder Regulator Relay

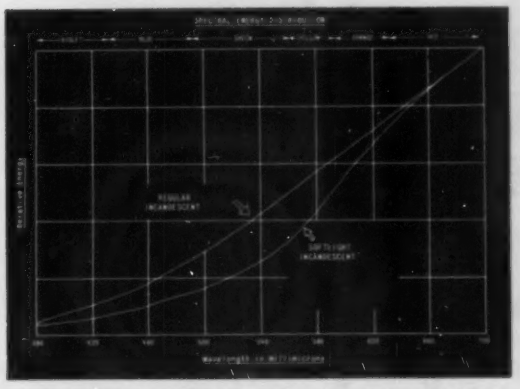
Feeder voltage regulators are said to have an improved voltage-regulating relay with cushion mounting to isolate vibration and reduce intermittent contact arcing. This prevents sporadic operation and allows contacts to make and break cleanly thus extending the life of relay contact tips. Another design change is the shape of the upper stationary contacts from a hemispherical to a flat shape.

General Electric Co, 1 River Rd, Schenectady 5, N. Y.

(*More New Products on page* 160)

Sylvania Softlight

pearl-pink bulb decorates as it illuminates



New Sylvania Softlight spectrum has greater quantities of warmer colors than regular incandescent lamps. More perfect diffusion, for sake of aesthetic appeal, cuts down over-all lumen output slightly.

Homeowners nationwide are buying up new Sylvania Softlight bulbs. Here is the long sought new dimension in home lighting . . . the newest concept in interior design. Now, beyond the basic dimensions of *quality* and *quantity* of light, Softlight captures the third dimension of *aesthetic appeal*—brings exciting new warmth, cheer, color accentuation into the home.

Softlight bulbs carry a special pearl-pink coating which filters out cooler colors of the spectrum—blue, green, yellow—and plays up the warmer hues. Greater masking of the filament softens, shadows, reduces glares. *Result:* a warm, pleasing, off-white glow that harmonizes with and favors warm-colored furnishings . . . flatters human complexions as well.

Yes, *decorating with light* is exciting news for you too! Be sure *you* have all the facts . . . send the coupon below for complete information. A Sylvania lighting specialist will call if you wish.

SYLVANIA®

. . . fastest growing name in sight

LIGHTING • RADIO • ELECTRONICS
TELEVISION • ATOMIC ENERGY

—SEND COUPON FOR DETAILED INFORMATION

Sylvania Electric Products Inc.
Lighting Division, Dept. **5L-2816**
60 Boston Street, Salem, Massachusetts

☐ Please send me a free copy of your complete descriptive paper, "Sylvania Softlight—A New Approach to the Third Dimension in Lighting."

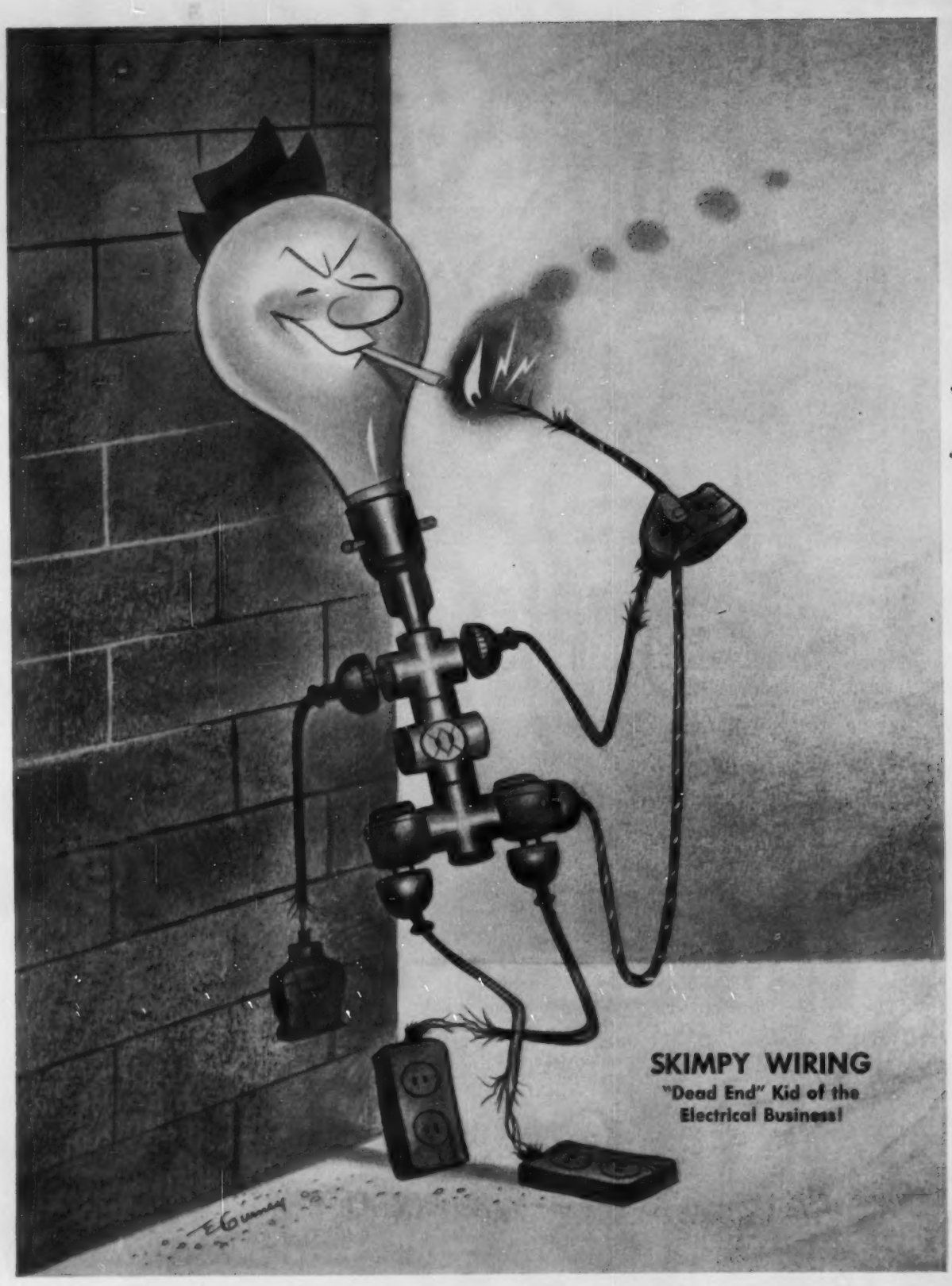
☐ Have a Sylvania lighting specialist call to demonstrate Softlight to me.

Name_____ Title_____

Organization_____

Address_____

City_____ Zone_____ State_____


SKIMPY WIRING
"Dead End" Kid of the
Electrical Business!

"DEAD END" KID OF THE ELECTRICAL BUSINESS!

Here's what Kennecott is doing about that problem child of your business—SKIMPY WIRING!

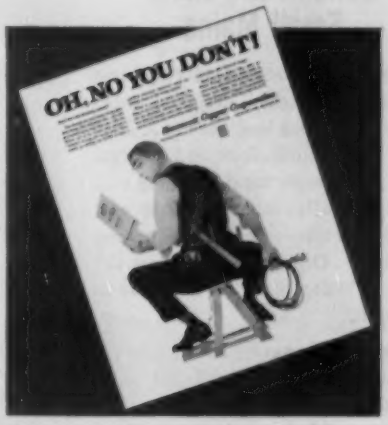
You know this evil little fellow. He's causing the biggest headache in the electrical business today. He keeps your homeowner-customers from getting all the electrical power their appliances need. He keeps *you* from selling all the power you should. He's costing you and your customers thousands of dollars every year.

How can you run Skimpy Wiring out of your territory? Only one way... *intensive education* of the owners of the homes in which Skimpy Wiring is so firmly entrenched today!

That is why Kennecott is running full-page ads like the one shown below in the Saturday Evening Post and This Week magazines. It's a campaign that tells millions of home-owners the vital story of adequate home wiring—and how to get it. It's a campaign that can put the full weight of national advertising prestige behind your own adequate wiring drives in your own area. Tie in with it now!

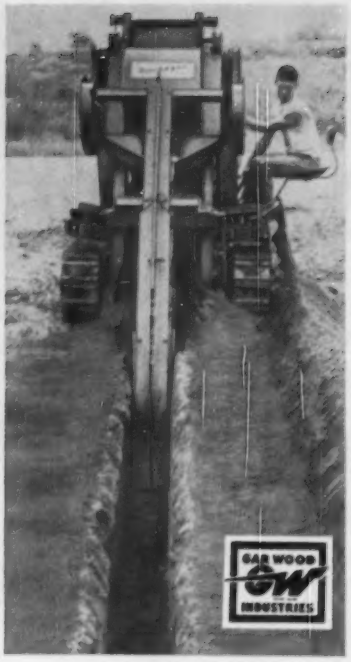
FREE! TIE-IN MATERIAL!

Add punch to your own local drive for adequate home wiring! Send today for free reprints and poster-sized blowups of Kennecott's full-page Saturday Evening Post and This Week magazine ads. Get free copies of the educational booklet, "The ABC of Home Wiring." Ask for complimentary home wiring Wall Chart, mat service folder and list of *at-cost* prices for large-quantity orders of all material available. No cost or obligation! Just write Kennecott Copper Corporation, Dept. W75, 161 East 42nd St., New York 17, N. Y.



Kennecott Copper Corporation

Fabricating Subsidiaries: CHASE BRASS & COPPER CO. • KENNECOTT WIRE & CABLE CO.



NEW BUCKEYE
MODEL 403
for Service Lines Conduit and Cable Small Mains

Here's the *first* and *only* low-cost production ditcher designed especially for service line work! . . . Digs flush with foundations and obstructions; eliminates hand finishing . . . Exceptionally maneuverable and highly mobile — *plus* fast ditching ability . . . Digs ditch 8", 10" or 12" wide to 5' depth; 14" or 16" wide to 4' depth.

WORKS UNDER ADVERSE CONDITIONS . . .
Full crawler mounted for high flotation and maximum traction with low ground-bearing pressure.

EASILY TRANSPORTED . . .
Small size and low silhouette permit fast job-to-job travel on small tilt-bed or flat bed trailer.

No. 5522

GAR WOOD INDUSTRIES, INC.
WAYNE, MICHIGAN

MORE NEW PRODUCTS

Jefferson Electric Co, Bellwood, Ill., offers a direct burial **constant wattage transformer** for use on multiple mercury lamp circuits. It is recommended for street, highway, parking lot and other outdoor lighting applications.

Ross Machine Tool Co, Box 122, Chicago Ridge, Ill., has a **portable spot welder** with a built-in electronic timing device.

Okonite Co, Passaic, N. J., offers a line of **splicing tapes** for use with standard steam or electric vulcanizers. Line includes rubber insulation, rubber sheath and colored neoprene sheath tapes. Ask for Bulletin 5505.

Mucalex Corp of America, Box 311, Clifton, N. J., offers "ceramoplastic" electrical **insulation** that is said to withstand radiation and temperatures up to 1,000 F without losing its properties. Material is made of pulverized synthetic mica bonded with high-grade electrical glass.

Kasson Die & Motor Corp, 32-14 Northern Blvd, Long Island City 1, N. Y., has a 10-kva, air-operated, fully-automatic **spot welder.**

Lance Products, Box 251, Forest Hills 75, N. Y., has a variable frequency **vibration table** for use in vibration testing, instrument shakedown, noise studies and location of intermittent faults in instruments.

Hickok Electrical Instrument Co, 10572 Dupont Ave, Cleveland 8, Ohio, offers a **portable stroboflash** instrument for rapid measurement of speed and the study of rotating, vibrating or reciprocating mechanisms in slow motion.

Chemical Coatings & Engineering Co, Broomall, Pa., is making Corrocote No. 362, a neoprene base **protective coating** that guards metals and other materials from moisture, oils, chemical fume and splash, salt air, and fungus corrosion.

Federal Pacific Electric Co, 50 Paris St, Newark, N. J., has a 30-amp **safety switch** with a shock-resistant fuse block, dual-blade construction and a high-pressure fuse holder. Available in general-purpose or raintight enclosures.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa., has:
Induction heaters rated 30 kw in either totally enclosed water-cooled or open air-cooled types.
Generator-type welders driven by gasoline engines. Available in current ranges from 550 to 350 amp, ac or dc.
Magnetic starters specially designed for control of hermetic motors in air conditioning and refrigeration units. Ratings are 20 amp continuous with 120 amp locked-rotor current and 30 amp, with 180 amp locked rotor current.
Automatic x-ray control with 100 or 200-ma transformers for continuous voltage variation from 30 to 125 kv in steps of 10 and 1.2 kv.
Lift-rotate and scanning spindle for automatically moving parts through induction heating coils and quenching them, following a preset cycle.

Steber Mfg Co, Broadview, Ill., offers cast aluminum pole top mounting **floodlights** for fully enclosed wiring. Details in Form 1074.

Buchanan Electrical Products Corp, Hillside, N. J., offers a Nylon Splice-Cap **insulator** for electrical and mechanical protection of spliced joints. Insulators are available in two sizes for wiring from two No. 18's through three No. 8's or two No. 6's.

Pyle-National Co, 1334 N. Kostner Ave, Chicago 51, Ill., offers a **warning signal,** called the "Type 15360 Gyralite," for use on moving equipment such as emergency vehicles. It revolves at 48 rpm and projects 96 flashes per minute in a horizontal plane.

Anaconda Wire & Cable Co, 25 Broadway, N. Y., has a **shuttle-car cable** with a heat resistant neoprene insulating compound for operation at 75 C. This, and a neoprene jacket, are said to increase resistance to puncture, cutting and crushing.

Herman H. Sticht Co, Inc, 27 Park Pl, New York, N. Y., has the Model SA-6 **tachometer** with an electronic control attachment that indicates and controls machine speeds, signals both audibly and visibly. It also can be used to open or close valves, and stop and start equipment at a preset speed.

The New Woodward Switching Station of the Arkansas Power & Light Company at Pine Bluff is a control center for the vast Middle South Interconnection. Load-Frequency Control and Telemetering are painstakingly matched to pool operating requirements—the work of E. C. Stewart, Systems Operator, in concert with a team of Leeds & Northrup Design and Application Engineers, two of whom are shown (standing) here. End result of their combined efforts: lowest operating cost consistent with reliable customer service. For a complete description of this installation, write to Leeds & Northrup Company, 4907 Stenton Avenue, Philadelphia 44, Pa. Or, talk with the men in any of 18 L&N District Offices—men who have made more than 300 matched-control installations.

LEEDS **NORTHRUP**

300 Load-Frequency Control Installations 1927-55

THIEL
TRANSFORMER HANGERS

MODEL	C-1	C-3
TRANSFORMER	75-100 KVA Single-Phase	75-112½ KVA Three-Phase
WEIGHT	46 lbs.	100 lbs.

● Thiel Hangers are made according to NEMA specifications—heavy gauge steel construction, hot-dip galvanized for dependable service and long life. Two styles complete with galvanized bolts and nuts. In stock for immediate delivery.

T-TYPE HANGERS in two sizes. For 3-50 KVA 1-Phase and 9-45 KVA 3-Phase transformers.

HANGER KICKERS in sizes to fit T-type hangers.

THIEL TOOL AND ENGINEERING CO. INC.
1417 No. Market St. • St Louis 6, Mo.

ANSONIA
Ankoseal
ALL-PLASTIC
QUALITY
cables

1. provide distribution circuits
2. deliver power to homes
and factories

The quality of Ankoseal is insured by rigid controls during manufacture. The results are high dielectric strength, dependability, long service life and quality service at low cost. Made for aerial, duct and direct burial installations. *Write for information on specific installation requirements.*

THE ANSONIA WIRE & CABLE COMPANY
ANSONIA, CONNECTICUT

CATALOGS AND BULLETINS

● **STORAGE EQUIPMENT:** Over two dozen ideas in space and time saving storage equipment are given in Catalog No. 702, 16 pages. Illustrations, descriptions and specifications are included. Frick-Gallagher Mfg. Co, 110 S. Michigan Ave, Wellston, Ohio.

● **GE BULLETINS:** Following are available from General Electric Co, Distribution Assemblies Dept, Plainville, Conn.

SERVICE COMPONENTS: Bulletin GEC-1031 contains list prices and brief descriptions of load centers, fuse pullers, molded case breakers, safety switches, lighting panelboards, busways and wireways for residential, light commercial, and industrial applications.

LOW-VOLTAGE DISTRIBUTION EQUIPMENT: Bulletin GEC-1032 includes all equipment in GEC-1031 (above) in addition to distribution panelboards, switchboards, control centers, and theatre lighting controls.

● **POWER TRANSFORMERS:** Booklet B-6524 tells how Form-Fit power transformers are designed to meet mechanical, thermal and dielectric requirements. A 7-page Trans-Vision section permits the reader to cutaway a complete transformer in successive steps that reveal construction features. Write on company letterhead to: Westinghouse Electric Corp, Transformer Div, Sharon, Pa.

● **BEARINGS:** Dimensions and ordering numbers for more than 1,000 powdered metal commercial bearing sizes are covered in a 30-page Standard Bearing Sizes booklet. Sizes for sleeve, flange, double and single hub spherical type bearings and thrust washers are included. Keystone Carbon Co, Powdered Metals Div, St. Marys, Pa.

● **PHOTOELECTRIC CONTROLS:** A 20-page illustrated booklet contains specifications, descriptive data and operational charts of photoelectric controls for industrial uses including high-speed counting, inspection and sorting, smoke control, high-temperature measurement and control, and conveyor control. Electronics Corp of America, Photoswitch Div, 77 Broadway, Cambridge 42, Mass.

● **VALVE INTERLOCK:** Folder No. 260 describes the technical aspects of an automatic interlock for valves to protect equipment when liquid flow is below a desired minimum or above a desired maximum. Hays Mfg Co, Industrial Sales Div, Dept. No. 419, W. 12th St, Erie, Pa.

● **REPRODUCTION MATERIALS:** All materials available from the manufacturer for the preparation and reproduction of drawings and documents are described in "Kodagraph Reproduction Materials", Eastman Kodak Co, Graphic Reproduction Div, Rochester 4, N. Y.

● **CRANES:** A 32-page catalog describes a variety of standard and special overhead cranes. Illustrations show crane applications ranging from ¼-ton hand operated units to 350-ton cranes. Data on planning installations and selection of correct types is included. Moffett Engineering Co, 579 Cleveland Ave, Albany, Calif.

● **RESTORER:** Catalog R-22 covers a restorer device for correcting inaccurate temperature reading and control caused by thermocouple circuit failure during heat treating and melting operations. Peerless Electric Co, Electronics Div, 1401 W. Market St, Warren, Ohio.

● **ASBESTOS:** A 16-page manual, called "Asbestos Textiles", covers asbestos lap, yarn, cloth, tubing, cord, wick, rope and tape. Illustrations and essential data on each form are included. Johns-Manville, 22 E. 40th St, New York 16, N. Y.

● **DIESEL ENGINES:** Heavy duty Diesel engines in sizes from 275 to 1,000 hp are described in a 20-page bulletin (Form 10,040). Ingersoll-Rand, 11 Broadway, New York 4, N. Y.

● **OVERHEAD CRANES:** A 20-page catalog illustrates and gives detailed information on top running double girder cranes with top running trolley and under running trolley in capacities from 2 to 12 tons, with spans up to 60 ft. Top running single girder cranes in capacities from 1 to 10 tons with spans up to 50 ft are also covered. Chicago Tramrail Corp, 1330 S. Kostner Ave, Chicago 23, Ill.

● **DETECTORS:** Remote detectors of far infrared energy are described and illustrated in a 4-page bulletin. Applications, wiring diagrams and ratings are given. Servo Corp of America, 2020 Jericho Trnpk, New Hyde Park, N. Y.

● **CONVEYOR TROLLEYS:** Catalog No. 2536, 20 pages, describes a line of trolleys for overhead conveyors. It contains dimensions and application data for the entire line, and descriptions of attachments. Link-Belt Co, Dept. PR, 307 N. Michigan Ave, Chicago 1, Ill.

● **COMPRESSOR:** A self-contained portable air-compressor is described in an 8-page bulletin (Form 2302). It also contains descriptions of the tools it will operate. Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y.

● **POTENTIOMETER:** Bulletin F 5760-1 describes a portable potentiometer. Construction, applications and ratings of various models are covered. Barber-Colman Co, Wheelco Instruments Div, Rockford, Ill.

● **FLEXIBLE COUPLINGS:** Where to use and how to specify flexible couplings to eliminate accidental shaft misalignments and load shocks is discussed in Bulletin No. 53. Dimensional drawings and tables show characteristics of 21 sizes of flexible couplings. Smith & Serrell, Inc, 200 Washington St, Newark, N. J.

● **PLASTIC COATING:** Bulletin No. M-3 discusses a strippable plastic coating for the temporary protection of lacquered, painted and enameled surfaces. Spraylat Corp, One Park Ave, New York 16, N. Y.

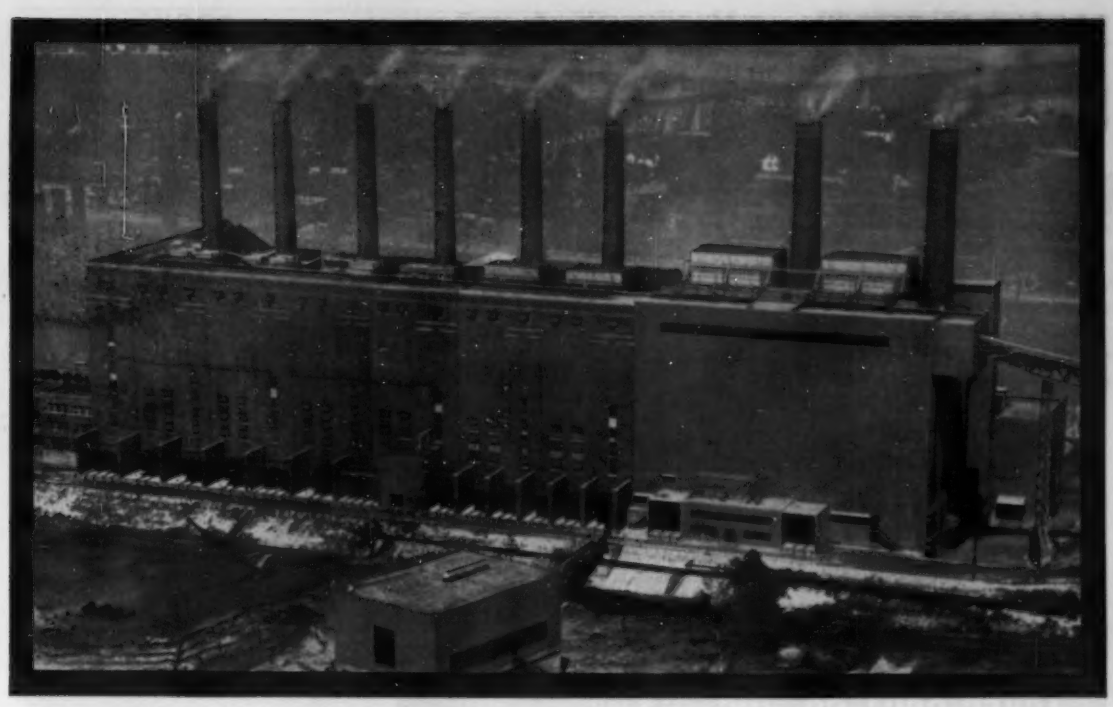
● **STEEL PRODUCTS:** Bulletin 11-2 is a buyers guide to steel bars, structurals, plates, sheets and strip. It contains information on standard specifications to which these steels are made, and type, range and accuracy of cutting to users needs. Joseph T. Ryerson & Son, Inc, Box 8000-A, Chicago 80, Ill.

● **INSULATORS:** A circular slide chart, called the Locke Switch and Bus Insulator Selector, enables the user to determine mechanical and electrical characteristics of cap and pin type insulator stacks for given operating voltages and basic impulse levels. Information includes stack height, leakage distance, dry arcing distance, bolt circle, rated impulse withstand, low frequency and impulse flashover and low frequency withstand characteristics. Locke Dept, General Electric Co, Baltimore, Md.

● **FIRE DETECTOR:** A 7-page bulletin contains illustrations, technical data and power information on two electronic fire detection systems. Electronics Corp of America, Fireye Div, Cambridge 42, Mass.

● **WIRE & CABLE:** Electrical wires and cables for the railroad industry are described in a 90-page illustrated booklet. Sections are devoted to insulation compounds, jacket compounds, electrical tapes and slicing compounds. United States Rubber Co, 1230 Ave. of the Americas, New York 20, N. Y.

BOOKS



Power plant picks a plastic tape...

SCOTCH 33's on the inside!

When the Union Electric Co., St. Louis, selected insulating tapes for their Venice Power Plant they looked the field over very carefully and chose "SCOTCH" Brand No. 33 Plastic Electrical Tape.

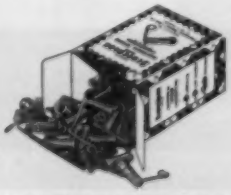
What's the reason? Finest materials, thoroughly modern processing methods and equipment, insure high quality to start with; quality control sees that high standards are maintained. One hundred sixty-four actual quality control checks, from raw material to finished product, leave no possibility of any deviation from prescribed standards.

Famous "SCOTCH" quality is found in *every* electrical product in the "SCOTCH" Brand family, including Electrical Spring Connectors, Insulating Putty, Splicing and Sealing Resins, Cable Splicing Kits and all the other "SCOTCH" Electrical Products. Remember "SCOTCH" Brand costs you no more per splice!

PRODUCT OF 3M RESEARCH

"SCOTCH" 33
Plastic Electrical Tape

"SCOTCHFIL"
Electrical Insulating Putty



"SCOTCHLOK"
Electrical Spring Connectors

"SCOTCHCAST"
Resin in "Unipak" Container

SCOTCH BRAND Electrical Products

The term "SCOTCH" is a registered trademark of Minnesota Mining and Manufacturing Company, St. Paul 6, Minn. Export Sales Office: 99 Park Ave., New York 16, N.Y. In Canada: P.O. Box 757, London, Ontario.

WHAT'S NEWS AT BRISTOL

How do you pick

acker utility digger sets poles in minutes!

The new Acker Utility Digger makes short work of pole setting. Its lightweight, compact design performs perfectly in rugged open country or crowded city streets. The basic unit mounts on jeep or small truck with either self-contained or power take-off.

LOOK at some of the exclusive features of this moderately priced digger.

1. Built-in power hoist and sheave have a capacity of 1500 lbs.
2. High speed auger digs holes up to 20" in diameter and depths of 10 feet.
3. Completely self-contained unit with no extra accessories to buy.
4. Finger-tip hydraulic controls for easy, one man operation.
5. Speedy operation saves time and money.

For complete details, write for bulletin **40EW.**

ACKER DRILL CO., INC. 725 W. Lackawanna Avenue, Scranton, Penna.

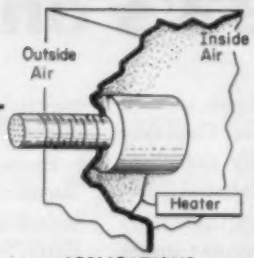
a complete line of Soil Sampling Tools, Diamond and Shot Core Drills, Drilling Accessories and Equipment

PREVENT CONDENSATION

maintain dry humidity

SYNTROL

DIFFERENTIAL THERMOSTAT



Keeps temperature in any outdoor enclosure at fixed point higher than outdoors—automatically.

Turns inside heater off when not needed.

Increases supplemental heat when needed during rapid temperature rise.

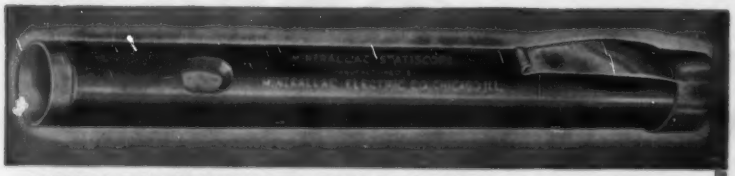
Rugged. Simple. Long-lived. Wide range of settings. Permits increased loads. Protects expensive equipment.

Let us know your protection problems and we will promptly send complete information.

APPLICATIONS

METAL CLAD SWITCHGEAR, MOTOR AND GENERATOR HOUSINGS. CONTROL HOUSES; BUS ROOMS. MECHANISM HOUSES. BATTERY CUBICLES. MACHINERY STORAGE BUILDINGS, ETC.

SYNTROL DESIGNS • **MARCELLUS, MICHIGAN**



"VOLT-TELLING STATISCOPE" protects worker

. . . when held in any alternating electrical field. Indicates presence of voltage in AC and Pulsating DC Circuits and in various electrical apparatus. . . . Pocket-size illustrated above, also in Station and Overhead Extension types. Thousands in use. Order from Electrical Jobber. Send for new literature.

MINERALLAC ELECTRIC COMPANY

MANUFACTURERS OF STATISCOPES, HANGERS, CLIPS, STRAPS, INSULATING AND CABLE-PULLING COMPOUNDS

25 NORTH PEORIA STREET • CHICAGO 7, ILLINOIS

BOOKS

Interprets Modern Physics

Modern Physics for the Engineer. Edited by Louis N. Ridenour. Published by McGraw-Hill Book Co, Inc, New York, N. Y. 499 pages, illustrated. Price $7.50.

Volume is a collection of lectures delivered at the University of California, Los Angeles, 1952-1953. Aim of the course and book is to keep engineers abreast of significant developments in the field of physical sciences, especially because of the drastic reduction in time lag between discovery and application. Individual chapters are written by 19 outstanding personalities in the field of physics.

Book is divided into three parts: 1. Laws of Nature—matter, radiation, and their interaction; 2. Man's Physical Environment—application of physical laws and techniques of investigation to the study of universe, earth, and air; 3. Information and its Communication—application of physics to electronics. In one volume this book takes the reader from Euclidean geometry to the relativity of Einstein. All fundamentals and their applications are discussed. Individual chapters cover such subjects as relativity, atomic and nuclear structure, magnetism, astrophysics, semi-conductors, and physics of the solid state.

All engineers should find this book useful because physics is the basis for nearly all branches of engineering. It will bring engineers up to date on the latest discoveries which for various reasons they so often miss.

Elementary Automation

Analysis of Feedback Control Systems. By Robert A. Bruns and Robert M. Saunders. Published by McGraw-Hill Book Co, Inc, New York 36, N. Y. 383 pages, illustrated. Price $7.50.

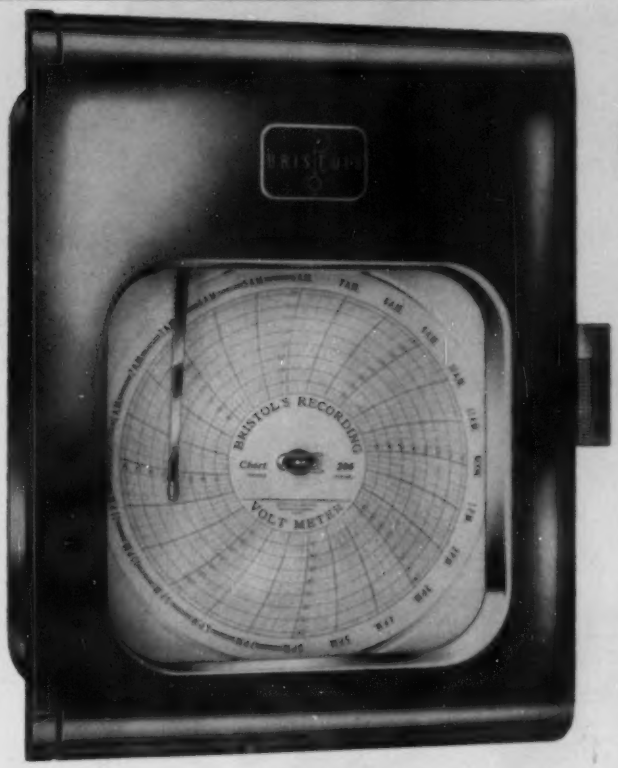
Dealing with servomechanisms and automatic regulators, this book presents a logical, understandable treatment of feedback control components and systems. It is designed as a collection and evaluation of previous literature, and presents a unified system of methods of analysis for the average technically trained person new to the field.

Readers should be able to use ac steady state circuit theory, fundamental laws of dynamics, and elementary differential equations. These are applied to the closed loop system, with emphasis on frequency-response methods. The book is broken into two sections: dynamic and transfer functions of components, and analysis of feedback control systems.

This book makes a good "first" for a student or utility man interested in the subject. It begins with Watt's flyball governor and ends with examples of discontinuous systems.

GENERAL ELECTRIC

WHAT'S NEWS AT BRISTOL . . .



PERMANENTLY MOUNTED Bristol Voltmeters and Ammeters come in three models: interchangeable surface and flush, surface-panel, and flush panel.

How do you pick the right recording ammeter or voltmeter?

The *right* choice for any voltage or current measurement and recording job is a Bristol Series 500 instrument.

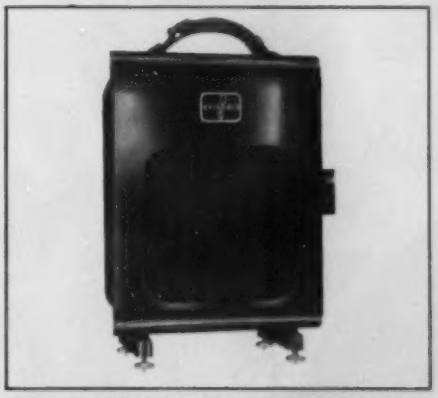
Why Bristol? Mainly because for sheer accuracy the Bristol Recorders can't be topped. Among the reasons for that are:

1. Low burden – the lowest burden of any round-chart recorder on the market.
2. Extremely high torque gradient.
3. Temperature compensated.
4. Shock-proof moving element mounting.
5. Leveling of instrument not critical.
6. Continuously legible recording of sudden changes – up to full scale value.

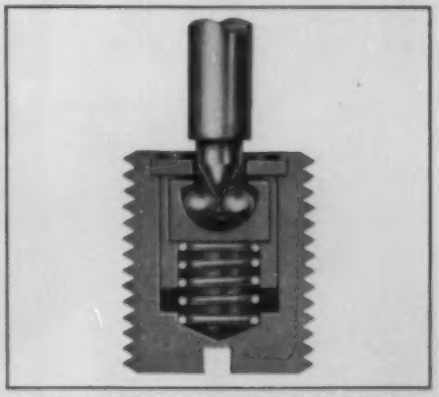
Also, Bristol's Series 500 Voltmeters and Ammeters are designed for easy use, with dust- and moisture-proof cases; quick-set chart hub for each chart changing; and snap-on chart plate.

Models offered that comply with ASA Specification C39.2.

Want more facts? Write for Bulletin E1111 to the Bristol Company, 116 Bristol Road, Waterbury 20, Conn. 5.19



SINGLE AND TWO-PEN PORTABLE BRISTOL RECORDERS are offered in two models: one chiefly for portable pole mounting and the other for general portable service.



NEW BALL-BEARING SUSPENSION, loaded by a coil spring, prevents damage even under severe mechanical shock. Corrosion-resistant stainless steel ball bearings are almost tool-hard.

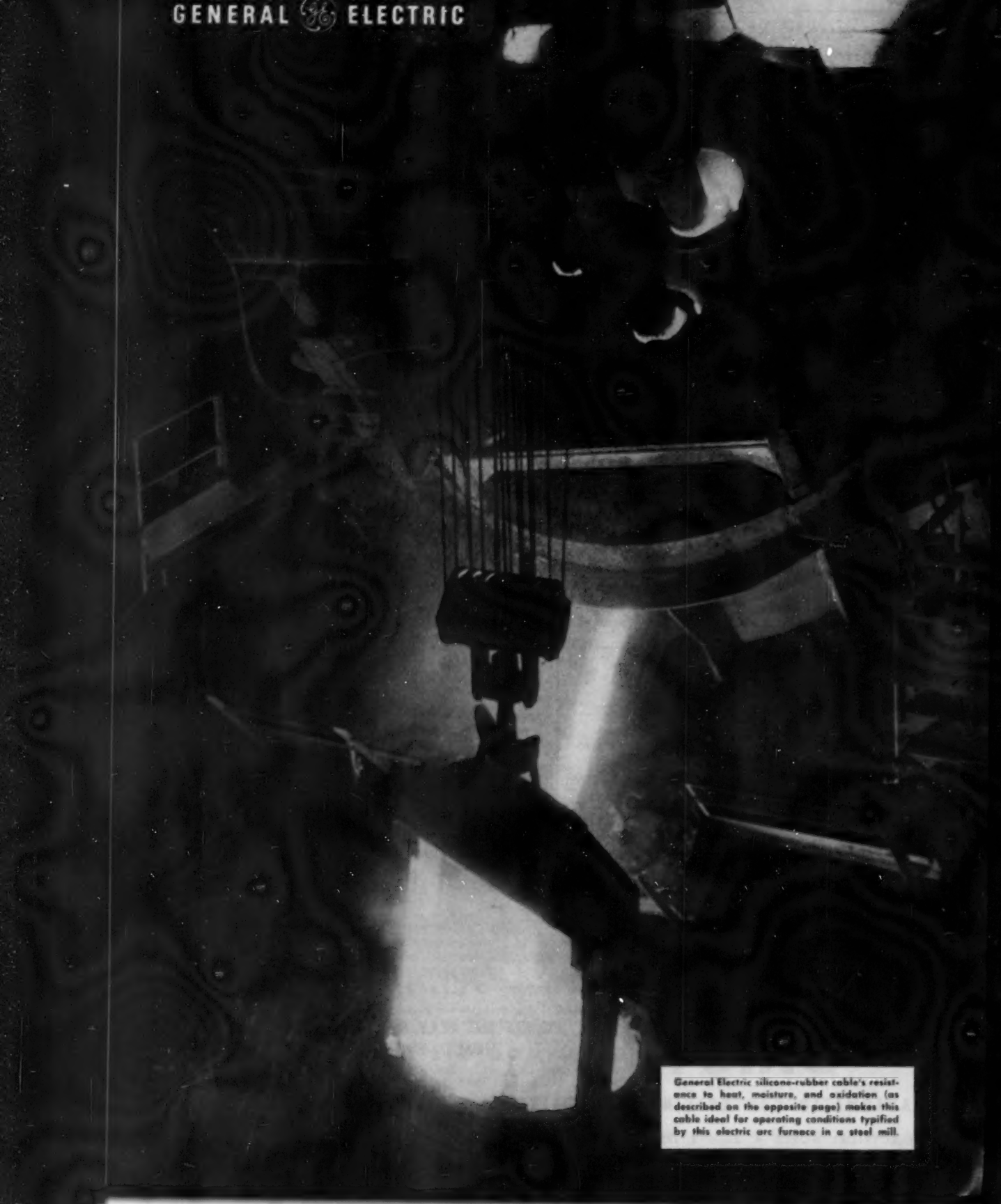
BRISTOL'S

BRISTOL

POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

GENERAL ELECTRIC



General Electric silicone-rubber cable's resistance to heat, moisture, and oxidation (as described on the opposite page) makes this cable ideal for operating conditions typified by this electric arc furnace in a steel mill.

IMPORTANT FACTS ABOUT NEW G-E SILICONE-RUBBER CABLES

New insulation permits high temperature operation for power and control circuits, equipment and generator leads

G-E silicone-rubber insulated cables, with higher ratings than ordinary rubber types, are now available for general plant wiring including power and control circuits, and equipment leads. These cables withstand higher operating and ambient temperatures—permit copper temperatures as high as 125 C for continuous operation. They maintain their electrical and physical properties, even through prolonged water immersion tests. Because silicone-rubber is moisture-resistant, no lead sheath is required.

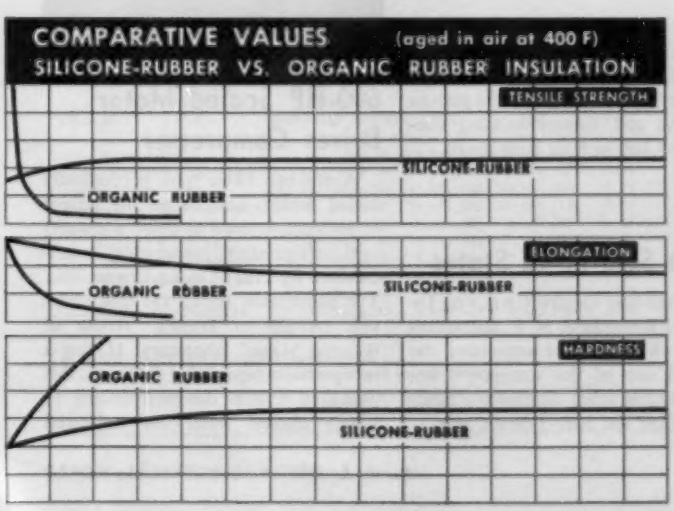
These advantages, plus excellent ozone resistance, are the reasons why silicone-rubber cables will maintain circuit integrity where other cables often fail.

The high temperature rating will often permit you to run greater loads through existing conduit or duct installations — and installation is a simple matter. G-E silicone-rubber cable is as flexible as rubber-insulated cable and can be handled just as easily. No special tools, fittings, or terminations are needed. The tough asbestos braid permits easy pulling through conduit. The cable can also be supplied with flexible armor for open installation.

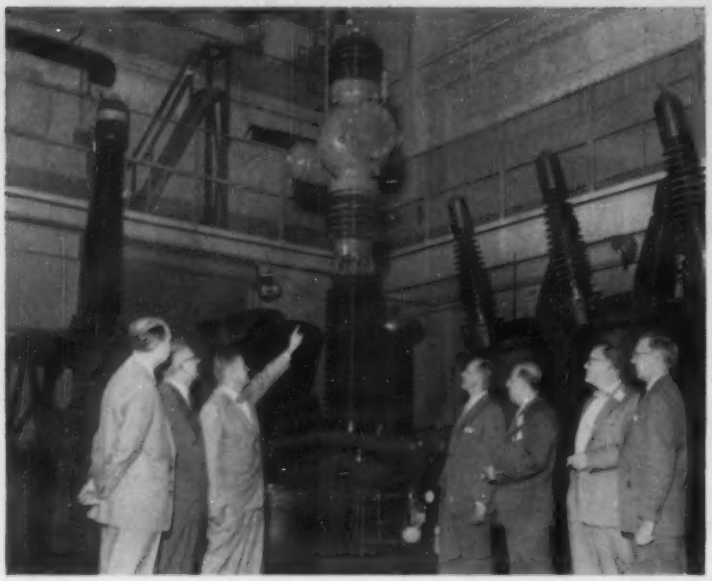
Write for the new free booklet for complete details. Section W156-827, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

Progress Is Our Most Important Product

GENERAL ELECTRIC



Organic rubber chars after several hours at 350 F — silicone-rubber is still flexible after hundreds of hours at 400 F.



GE Tests New 138-Kv Air-Blast Breaker

Tests of a 138-kv, 10,000-Mva air blast circuit breaker, reportedly the first of its rating being manufactured in the United States, were conducted recently by General Electric Co's High Voltage Switchgear Department at Philadelphia. Among those present were engineers of Consolidated Edison Co of New York, Inc, which has ordered twelve of the breakers.

The new air-blast breaker has been under development for three years. It begins a new line which will eventually be available in ratings up to 330 kv.

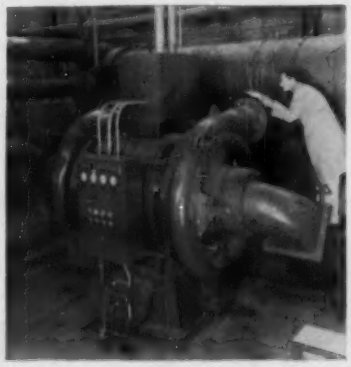
The breaker uses high-pressure compressed air to "blow out" electric arcs and, for a split second, interrupt flow of electricity when lightning strikes or a fault occurs on a transmission line. Interrupting elements, moving contacts, operating linkage and air-blast valves are in the steel pressure vessels near the top of each porcelain column.

Con Edison's engineers are shown viewing a single-pole component of the new breaker. In right background is a conventional oil-filled breaker of same rating, and in left background is tank of an oil-filled breaker of GE's lenticular design. New air-blast breaker supplements the other two types of circuit breakers.

German Firm Builds Wind Generator For Ireland

A propeller-type wind generator will soon be installed on a hill located on the Irish coast near Dublin. The unit was built by Allgair G.m.b.H. of Stuttgart, Germany for the Irish Electricity Supply Board. After tests are conducted at this initial installation, the device will be set up in other locations. It is expected to take about ten years to determine if this method of generation is economically feasible in Ireland.

Windmill is of conventional design and will be mounted on a tubular steel tower 33 ft high. Three propeller blades, made of pressed sheet-metal, inscribe a circle 33 ft diam. The generator is an induction-type unit rated 380 v, 3-phase, 50 cycles. Its synchronous speed is 1,500 rpm at a windwheel speed of 82 rpm. Generator full-load rating is 9 kw and is obtained at wind velocities of 22 mph and up. However, maximum efficiency obtained at about 16 mph. Speed or load is normally varied by changing the pitch of the blades.



600-HP Sealed Motor Drives Compressor

A 600-hp, 3,600 rpm, hermetically sealed motor, said to be the largest of its kind, is used to drive a centrifugal refrigeration compressor manufactured by Trane Co, La Crosse, Wis. The illustration shows the assembled unit on test in Trane's "House of Weather Magic" laboratory. Having a refrigeration capacity of 800 tons, this packaged unit is designed mainly to supply chilled water for industrial

Texas Co to Expand Research Facilities

Texas Co is constructing three new buildings to be completed by spring, 1956, as the first phase of an extensive expansion of research and testing facilities, August C. Long, president, announced recently. The current program calls for two buildings at Texaco's largest research center at Beacon, N. Y., and one building at the company's largest refinery at Port Arthur, Texas.

Scheduled for Beacon is a 4-story, 29,300 sq-ft, Analytical and Testing building and a 3-story, 34,100 sq-ft addition to the present administration building. Port Arthur will get an Analytical and Testing building containing 45,100 sq ft of floor space.

To Be Sold in 48 States

Westinghouse Electric Co (Lamp Division) of Bloomfield, N. J., announces that all 48 states have authorized the sale and use of the company's improved sealed beam automotive headlamp called the Safe-T-Beam unit.

process applications and for air conditioning systems in large buildings and factories. Motor is a product of the Louis Allis Co and is available in ratings of 208, 220, 440 and 550 v.

AMF Produces Nuclear Devices in Volume

Master slave manipulators, devices for handling radio-active materials in nuclear research, heretofore made-to-order, are now being produced in quantity for the first time by AMF Atomics, Inc, subsidiary of American Machine & Foundry Co.

Stockpiling of these manipulators is in accord with the company's plan to become the industrial "department store" for atomic energy equipment. Included in the firm's "shelf items" are other handling devices and control mechanisms for reactor systems.

AMF's atomic energy program includes work on reactor equipment, reactor systems, and radiation treatment machinery. Among its current activities is the construction of a research reactor for The Battelle Memorial Institute in Columbus, Ohio.

Nelson Electric Expands

Nelson Electric Manufacturing Co of Tulsa, Okla., has started on a four-building project which is expected to be finished by January, 1956. The project is estimated to cost $750,000 and is located at 41st St. and Sheridan Road in Tulsa.

500TH APPARATUS BUSHING designed in accordance with ASA standards is crated for shipment at Pittsfield

Locke Ships 500th ASA Standard Bushing

Locke Dept of General Electric Co recently shipped its 500th apparatus bushing designed in accordance with the new ASA standards. The Standards establishing electrical and mechanical characteristics of bushings in the 23-69 kv range were adopted by the industry in September of 1954.

Locke ASA Standard bushings feature center clamping which places the porcelain in compression, complete sealing which cuts maintenance to a minimum, and ease of repair since the porcelain can be replaced without removing bushings from apparatus, says the manufacturer.

Illustration shows a 400-amp transformer bushing, rated 34.5 kv.

MANUFACTURERS' EARNINGS

COMPANY	PERIOD MONTHS	ENDED	NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
Allis-Chalmers Mfg.	6	June 30	$12,562,932	$13,490,504	$3.08(a)	$3.94(a)
Arrow-Hart Hegeman Elec.	6	June 30	1,145,80	825,917	2.29	1.65
General Electric Co.	6	June 30	101,892,000	93,556,000	1.18	1.08
International Business Mach.	6	June 30	23,870,992	21,600,314	5.82	5.27
Kaiser Aluminum & Chemical.	4	May 31	9,446,000	4,289,000	0.67(a)	0.28(a)
P. R. Mallory & Co.	6	June 30	1,192,984	313,383	1.66	0.23(a)
Minn.-Honeywell Regulator.	6	June 30	7,240,898	7,109,778	1.13	1.12(b)
Monsanto Chemical.	6	June 30	16,409,680	11,897,710	1.02(c)	0.71(c)
Okonite Co.	6	June 30	672,331	511,413	3.72(a)	3.01(a)
Sylvania Electric Products.	6	June 30	6,088,019	3,822,705	1.90	1.08

(a) Based on number of shares outstanding.
(b) Adjusted to reflect two-for-one stock split in April 1955.
(c) Adjusted to give effect to the three-for-one stock split of July 11, 1955.

Manufacturers Briefs

Owens-Illinois Glass Co of Toledo, Ohio, directors have recommended a two-for-one split of common shares with a par value of $6.25 per share; to be voted at a meeting September 14 in Toledo.

American Brass Co recently broke ground for a $2.5 million plant at Mattoon, Ill. The plant will be a one story building containing about 86,000 sq ft of floor space for the manufacture of flexible metal hose and tubing. Operation of the facilities is expected to begin in Jan. 1956.

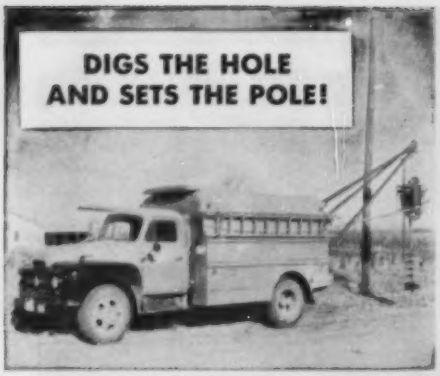
Resistance welder orders, reported by Resistance Welder Manufacturers Association, for the first six months of 1955 are 31% ahead of the first half of 1954. Shipments for the same period are 22% ahead of shipments during the corresponding period last year.

Westinghouse Electric Corp has been awarded a contract in excess of $1.5 million for the installation of 22 automatic elevators in the New York Coliseum.

Walworth Co of New York City acquired on July 25 the assets and business of M&H Valve & Fittings Co of Anniston, Ala. Under the terms of the acquisition, Fred W. Belz, president of Walworth, announced that M&H stockholders would receive 5.1 shares of Walworth common stock for each common share of the Alabama company.

Ceramic Fiber Project is a new operating unit of Carborundum Co, Niagara Falls, N. Y. Otto R. Stach is project manager. The new unit will manufacture Fiberfax, a cotton-like mass of fine fibers blown from molten aluminum oxide and silica. The fiber is said to remain stable at temperatures as high as 2,300F.

Magnavox Co has developed a new type of electronic data processing machine which translates analog information into digital form and feeds this information into an International Business Machines Corp's Model 701 data processing machine. This is said to be the first time this conversion has been made completely automatic, operating at the rate of 225 data points per sec.



The F & H Self-Powered Hole Digger can be used on any type A Frame. Has own power for raising machine and turning auger. No power take-off shaft required. Available in 8-HP Briggs & Stratton and 14-HP Wisconsin engine. Uses either bucket or spiral-type augers. Dirt is thrown off the auger by spinning. Operated by only one man. All controls are mounted on digger. Write for complete information today.

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. . . in the dynamic
electric power
industry,
only World can do*
World's work . . .*

***Electrical World**
that is . . .

Neah Bay L&P Station Razed by $75,000 Fire

The steam power generating plant of the Neah Bay Light & Power Co at Neah Bay, Wash., was destroyed by fire late last month at an estimated loss of $75,000.

The fire, occurring at the height of the fishing season, created a refrigeration problem. Two big commercial fish-buying stations and scores of commercial and sports boats were dependent for ice upon refrigeration plants which obtained power from the Neah Bay company.

Efforts were being made to bring in a Navy vessel to furnish power.

A 600-kw barge-mounted generator set was sent in by the Navy to end the two-day power famine which resulted from the fire. The generator unit was operated by the Clallam County PUD.

Service Division Agreement Made by NW Co-op, PUD

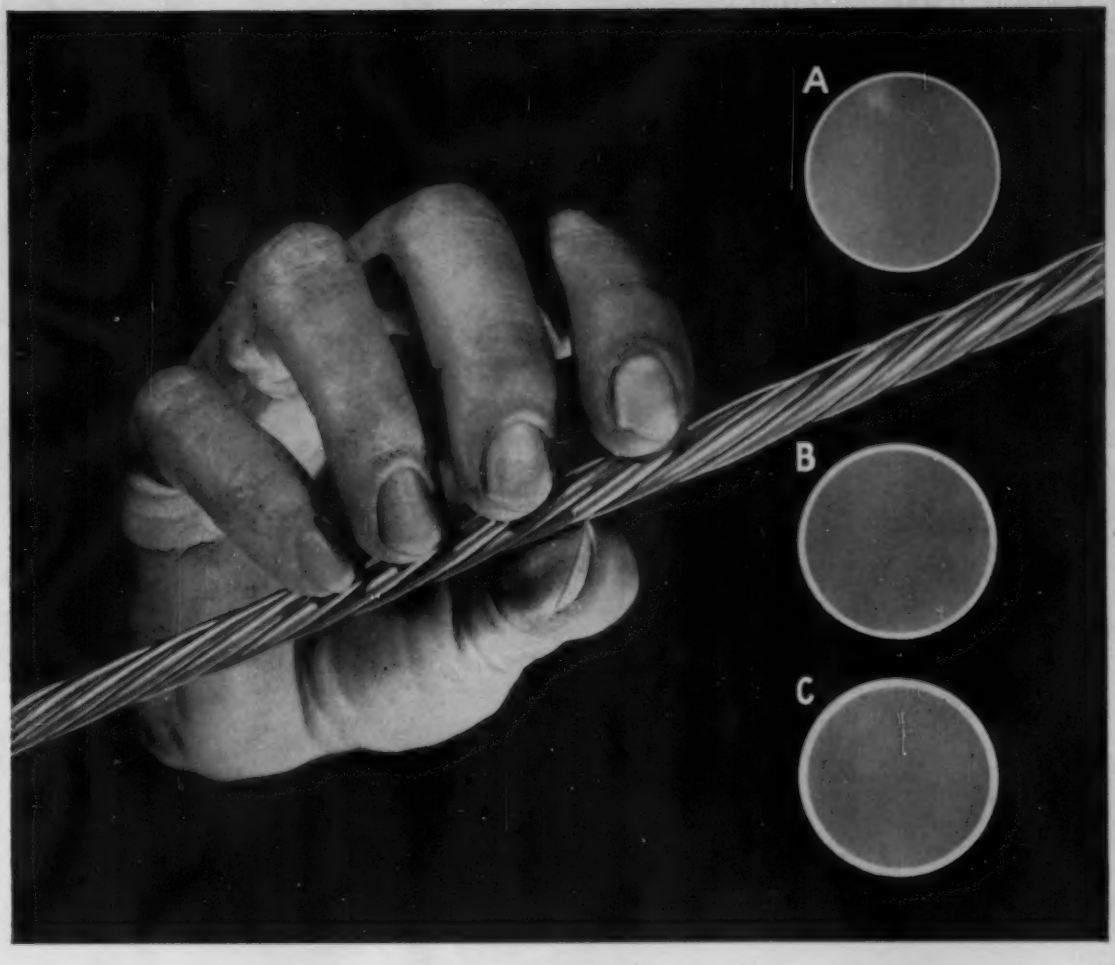
The Franklin County PUD of Pasco, Wash., and the Big Bend Electric Co-operative of nearby Ritzville have agreed to divide all new irrigation blocks in the Department of the Interior's Columbia Basin project for electric service.

The PUD has agreed to buy from the co-operative 7.75 mi of single-phase line and 12 mi of three-phase line in Irrigation Blocks 14, 18 and 19 near Connell for $49,875. It will be the exclusive service agency for that area, as well as for parts of Blocks 20 and 116. The co-operative will serve other parts of Blocks 20 and 116 and all of 11, 12, 13, 15 and 21.

Heat Wave Hits Vepco's Lines With Record Load

The use of air conditioning in the recent heat wave put the heaviest load in history on Virginia Electric & Power Co's lines. Vepco announced that its peak load during the heat wave was 1,038,000 kw. Power output for a 24-hr period was 19.2 million kwhr. This is more than 10% over last summer's peak.

The heaviest load came on the same day that the first of four 25,000-kw units at Vepco's Roanoke Rapids Dam was placed in operation.



Strand Lives Longer When Rust Stays Out

The life-span of your strand depends heavily upon the coating that shields the ferrous wires. The better this jacket holds up, the less chance there is for rust to gain a foothold. That's why Bethlehem went all out, nearly 20 years ago, to develop a coating that would really *protect* against rust.

The development work resulted in the *bethanized* coating, which has stood the test of time.

Applied electrolytically, this zinc armor is so pure, so uniform and ductile, that it will not crack or peel even under repeated bending. It offers no tiny crevices or "checks" in which rust can get started. It keeps corrosive atmosphere completely away from the wires.

But there's another big advantage to specifying Bethlehem strand with the bethanized coating. This coating is available in three different weights, making possible a choice for every field condition. The lightest, coating A, is the thickness of extra-galvanized. Coating B is twice as thick as A; coating C, three times as thick as A. All meet standard ASTM specifications.

For the long-term jobs, the two heavier coatings are especially recommended. Actually, they cost little more than the A-weight; but under parallel conditions they last much longer. They're a real "buy."

Full details about Bethlehem strand are available at our nearest sales office. If you will call or write us, we'll gladly see that you receive complete information.

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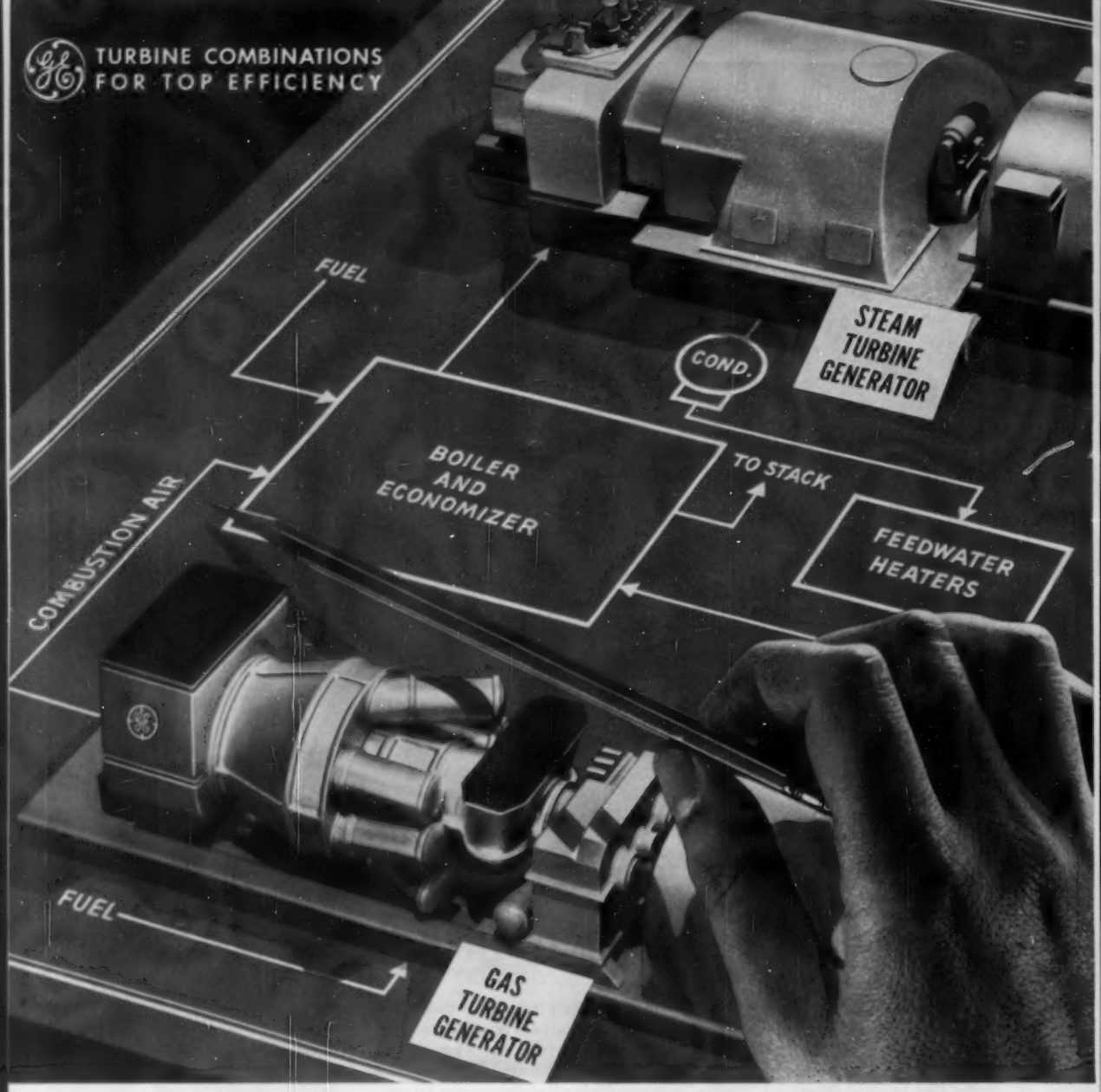
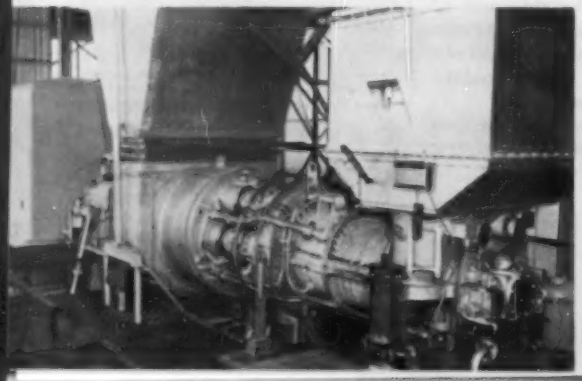


EXAMPLE OF GAS TURBINE used in a combined gas-steam turbine cycle is shown below installed at a Southwestern utility. Use of gas turbine exhaust for feed-water heating resulted in 15% improvement in station heat rate.



G-E GAS TURBINE PLANT shown below is devoted exclusively to the development and manufacture of commercial gas turbines. General Electric gas turbines have over 730,000 hours of operation to their credit—a world's record.

EFFICIENCY GOES UP when this G-E steam turbine-gas turbine team goes into action. Here, exhaust gas from gas turbine is used as combustion air for steam boilers. Result is 7.5% improvement in system efficiency.

NEW WAY TO IMPROVE HEAT RATE:

G-E gas turbine exhaust used as boiler combustion air

When combined with a steam turbine in a generating plant, the G-E gas turbine can make a significant contribution towards over-all electric generating station efficiency and resulting economy.

IN THE EXAMPLE AT LEFT, exhaust gas from the G-E gas turbine, which retains over 80% of its original oxygen, is used as preheated combustion air for fuel-fired steam boilers. The gas turbine itself drives a generator in parallel with the main turbine-generator.

TAKE A 6000-KW GAS TURBINE, for example. It provides all the combustion air required for a boiler supplying 1250-psig, 950 F steam for a 40,000-kw condensing steam turbine. Net heat rate for such a plant would be 10,760 Btu/kwh as contrasted to 11,630 Btu/kwh for a steam plant without a gas turbine. The improvement is 7.5 per cent.

IN DOLLARS AND CENTS, that represents a $420,000 per year saving as a result of using a gas-steam turbine cycle (based on 70% plant factor, 15% gross fixed charges, and 25¢ million Btu for fuel).

SIMILAR ECONOMIES ARE obtainable with other gas-steam turbine cycles. For details on the arrangement most useful to you, contact your G-E Apparatus Sales Representative, or write for Bulletin GER-1026. Address Section 261-5, General Electric Company, Schenectady 5, New York.

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Two Utilities Elect Franklin Hollis President

F. HOLLIS

Franklin Hollis, a director of the New Hampshire utilities, Concord Electric Co and Exter & Hampton Electric Co, has been elected president of both companies. He remains director of the two firms. As president, he succeeds his father, Allen Hollis, who died this past April (EW, May 16, p 199).

The younger Hollis, as a member of the law firm of Sulloway, Jones, Hollis & Godfrey of Concord, N. H., has been active in work for New England utilities. His duties have involved him in matters of finance, labor and rate negotiations with public utility commissions.

In addition to his other positions, Hollis serves as director and chief counsel of Public Service Co of New Hampshire, president and director of Concord Steam Corp, director of Rumford Printing Co, and trustee of Union Trust Co. Since 1950 he has also been a member of the New Hampshire State Board of Education, following a long term as a member of the local school board.

Hollis is a graduate of Harvard College and a former student at Harvard Law School.

Dawson Made Director, VP of Du Pont

D. H. DAWSON

E. I. duPont de Nemours & Co, Inc, has elected David H. Dawson a director, vice president, and a member of the executive committee. Dawson is assistant manager of Du Pont's textile fibers department.

Dawson, who is 46 years old, has been with the company for 22 years. During that time he has had wide experience in research, production, and sales in many of the comany's departments.

He has been in the textile fibers department since 1953, first as assistant general manager in charge of manufacturing and then as assistant general manager of the department. Previously, he had been assistant general manager of the pigments department and of the plastics and finishes department.

Graduating from Drexel Institute of Technology in 1930 with a degree of bachelor of science in chemical engineering, he entered Ohio State University as a graduate assistant. He received his PhD in 1933.

Electrical League Elects Chairman

C. T. BREMICKER

Carl T. Bremicker, vice president in charge of sales for Northern States Power Co, recently was elected chairman of the North Central Electrical League.

Other officers elected at the same time were: J. L. McEachin of the Minnesota Power & Light Co, Duluth, first vice chairman; Ralph J. Moudry, Square D Co, second vice chairman; Glen Rowell, Minnesota Electrical Inspectors Association, treasurer; and Harry S. Davis, Electrical Jobbers Equipment Co, secretary.

Bremicker, a native of Illinois, has been with Northern States in various capacities since 1924. He became assistant general sales manager in 1945 following his return from the Army. In 1948 he was made vice-president in charge of sales.

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You get the most efficient use of company vehicles when you can reach your maintenance crews by telephone at any time. The Bell System offers several types of Mobile Radio arrangements.

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Signaling Service: Your maintenance crews can be signaled over this one-way service and carry out any prearranged instructions, such as calling your office from a public telephone.

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POWER PLANT MANAGEMENT

This practical guide makes plain the techniques management men need to run a power plant smoothly and efficiently to put out dependable power at lowest practical cost. Covers a wide range of topics, from the purchasing and use of equipment, and its safe and efficient operation, to the hiring, training, and supervision of operators. Shows how to correlate and weigh objectives, costs, and equipment characteristics to determine best courses of action. Includes yardsticks for measuring effectiveness of management and supervision. **By R. H. Emerick, Consulting Mech. Engr. 339 pp., 74 illus., $6.50**

Just Out

INDUSTRIAL POWER SYSTEMS HANDBOOK

Better operation and service —more safety—greater economy — flexibility — easier upkeep and expansion — these are advantages this book can give to industrial power distribution systems. Use it for planning and maintenance of electrical facilities for industrial plants or commercial buildings. Gives a wealth of examples, engineering methods, and design data—based on General Electric experience. **By Donald L. Beeman, Mgr., Ind. Power Sec., General Electric Co. 971 pp., 516 illus., $12.50**

ENGINEERING VALUATION and DEPRECIATION

Gives in detail effective systematic appraisal procedures and techniques to follow in finding the value of industrial, commercial, utility, and natural-resource property. Explains various appraising tools . . . where to get data . . . how to use property. Explains various appraising tools . . . how to take inventory . . . how to get and analyze cost data, price, and construction cost. Gives a special view of depreciation as it applies to appraising, and help for appraising limited-life properties. **By Anson Marston, Iowa St. Coll., Robley Winfrey, Iowa St. Coll., and Major J. C. Hempstead, U.S.A.F. Academy. 2nd Ed. 486 pp., 31 illus., 74 tables, $8.00**

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PERSONAL BRIEFS

C. Evan Parks, an engineer with Public Service Co of Indiana for 22 years, has joined Iowa Southern Utilities Co as assistant to the executive vice president. In his new post Parks is responsible for the company's engineering and operating departments.

Connecticut Light & Power Co has assigned **Charles P. Jones,** district engineer at Danielson, to Eastern Division headquarters to assist the division engineer. **Robert E. Miller, Jr,** assistant engineer at CL&P's Berlin general headquarters, succeeds Jones.

George Nostrant has been promoted by Pacific Power & Light Co from chief load dispatcher to assistant general superintendent. He is succeeded by **J. T. Holbrook,** district power superintendent at Yakima, Wash. PP&L has also appointed **Dallas B. Forest,** Clatsop district office manager, to the new post of area sales manager for Hood River, The Dalles, Pendleton, Enterprise, and central Oregon districts.

William A. Hibbert, assistant treasurer of Delaware Power & Light Co, has been elected treasurer to succeed the late **Edward L. Stack. Joseph M. Regelski,** statistician, has replaced Hibbert as assistant treasurer.

New York State Electric & Gas Corp has promoted **Howard A. Praeger** from assistant advertising manager to sales promotion manager. His headquarters will remain at Binghamton, N. Y. . . . **Nils T. Sellman,** assistant vice president of sales, has retired from Consolidated Edison Co of New York, Inc.

Edward C. Fiss has been named director of a special development section recently created by Duke Power Co to study atomic energy application for power generation. Fiss has been chief chemical engineer of Duke's steam production department. . . . **Albert J. Hamilton,** director of power economics for Sacramento Municipal Utility District since 1952, has been granted a leave of absence to spend three years as power economics consultant in Belo Horizonte, Brazil, for the Centrais Electricas de Minas Gerais. The firm is planning a one-million kw hydroelectric development.

Robert O. Whitman has been elected treasurer of American Gas & Electric Co and its operating subsidiaries. He was previously assistant treasurer of these companies. . . . **Norman Wicks** has resigned as manager of National Adequate Wiring Bureau, NEMA Business Development Department, to join General Precision Laboratories, Inc, of Pleasantville, N. Y.

The following appointments have been made to state regulatory bodies: **Aaron L. Jacoby** and **Richard H. Balch,** to New York State Public Service Commission; **Allen S. Boyd,** to Florida Railroad and Public Utilities Commission to fill the unexpired term of **Richard A. Mack,** recently named to the Federal Communications Commission; **Roy C. Papalia,** to Massachusetts Department of Public Utilities; **Ralph Moody,** to North Carolina Utilities Commission; **Roy C. Jones,** to the chairmanship of Oklahoma Corporation Commission replacing **Ray O. Weems** who retired because of ill health; and **Ralph C. Horton,** to the chairmanship of the Public Utilities Commission of the state of Colorado.

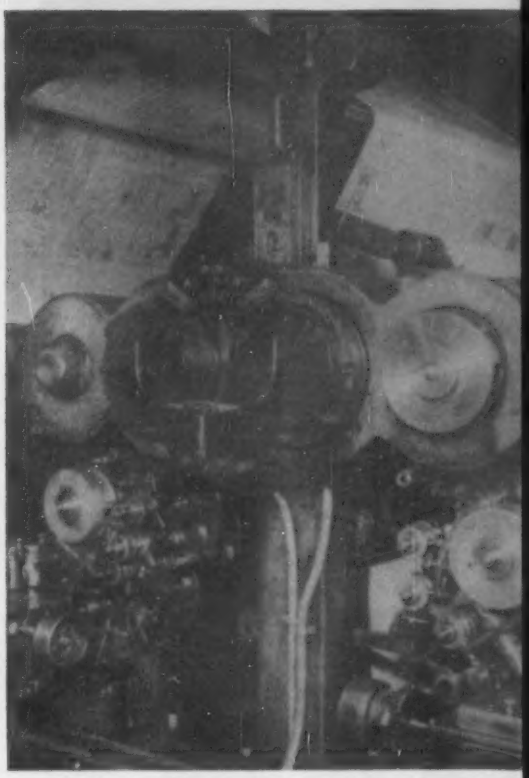
Burns & Roe, Inc., engineers and constructors, have created an Industrial Division in Baltimore, Md., to offer industry engineering and construction service. **Richard W. Black** has been appointed division manager. He previously headed the Design and Engineering Division of Industrial Corp, a Baltimore management consulting firm.

Allis-Chalmers Manufacturing Co has announced these appointments: **F. J. Geiger** has been promoted from manager of sales and engineering, electrical section, to general manager at Norwood (Ohio) Works; **Emil Gross,** chief engineer of the hydraulic department since 1950, has been named consulting engineer; and **Paul D. Hess** succeeds Gross as chief engineer.

E. A. Schmidt has been promoted from Chicago district manager of I-T-E Circuit Breaker Co to mid-west regional manager. This region includes sales offices in Chicago, Cincinnati, Cleveland, Detroit, Indianapolis, Kansas City, Minneapolis, Omaha, and St. Louis.

engineered lighting

for hazardous and specialized locations



Wheeler VAPOR TIGHT

These specialized Wheeler fixtures combine superior lighting efficiency with extraordinary resistance to moisture and vapors. Insurance against costly product spoilage from lamp breakage or falling lamps is provided by the heavy cover furnished with each of these carefully engineered units. Equipped with plain clear glass, or with tempered plate glass where required to withstand shocks and impacts.

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- PRESS ROOMS
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Wheeler "SERIES II" DUST-TIGHT

Fully comply with all Underwriters' requirements for installation in Class II, Group G, Class II, Group F and Class III locations. These hazardous locations involve the presence of atmospheres containing combustible dusts or ignitable fibers or flyings.

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- WAREHOUSES
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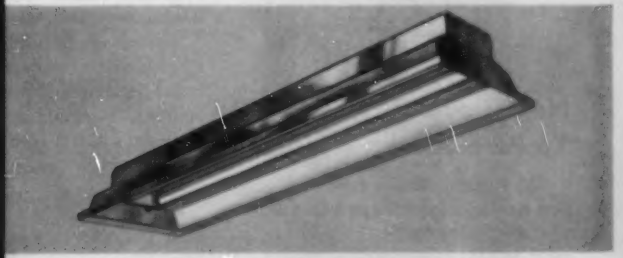

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One-piece construction and seamless porcelain enamel finish makes these specially designed units ideal for textile mills or any other industry where severe moisture and humidity conditions exist. Engineered for long, trouble-free service. Accessory glass covers available.

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Tacoma Ups Rates

. . . for eight large industries in new contracts; hike viewed as 'serious step' for the area

Eight large industries at Tacoma, Wash., will pay higher electric rates in new contracts with Tacoma City Light, as the result of authorization granted the Public Utilities Board by the City Council.

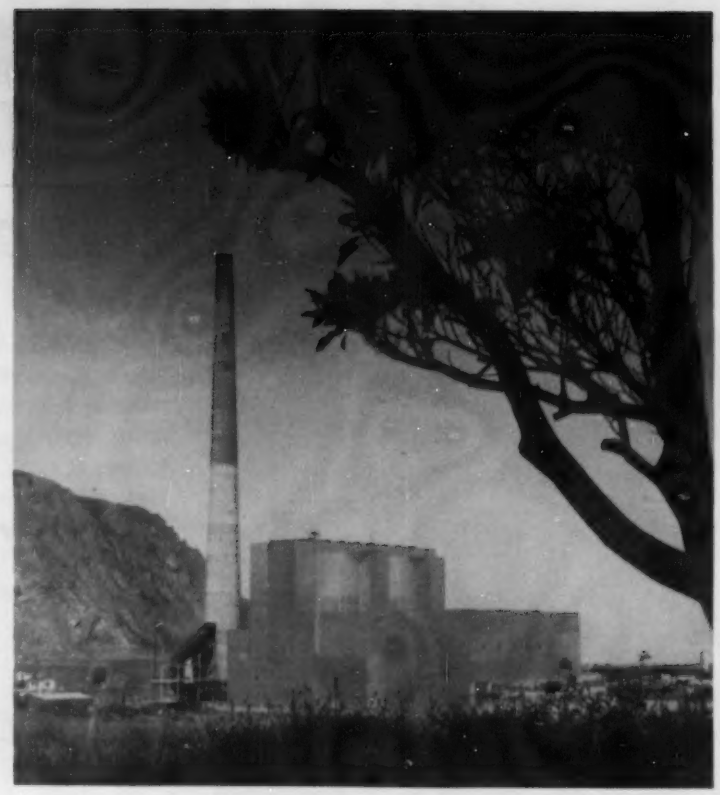
T. E. Moffit, president in charge of western production of the Hooker Electro-chemical Co, told the Council the eight firms were "reluctantly willing" to go along with the proposed changes in the contracts, but warned that the change is a "serious step" for Tacoma.

The city is not now competitive for heavy industrial power users and, with the change, will become even less so, he said.

If City Light is anticipating increased costs because of the Cowlitz River development and that is necessary, Moffit said, then the affected industries are in favor of the contract changes. But if such changes will hurt Tacoma industrially, then perhaps the Cowlitz project should be re-examined, he said.

Mayor Harold M. Tollefson declared electric rates might go even higher without the Cowlitz project, due to an expected increase in Bonneville Power Administration's rates.

The industries will be geared to the BPA schedule for electric costs. Present industrial rates will be increased approximately 6%, with another increase likely when Bonneville rates are increased, probably next year.



Pacific G&E Opens Morro Bay Plant

The streamlined Morro Bay Plant (above), which will have a 300,000-kw capacity when its second generating unit is installed sometime next year, was dedicated recently by Pacific Gas & Electric Co. During the dedication ceremonies, the plant's first unit began its "shakedown run."

Located at the mouth of Morro Bay in San Luis Obispo County, Calif., the new plant has a submarine pipeline for direct delivery of fuel oil from ocean-going tankers. Special evaporating equipment converts sea water into chemically pure water for use in the plant's boiler system. Two sets of "triple-effect" evaporators have been installed, one for each generating unit. A final main-station evaporator further purifies the water for use.

The plant's streamlined effect is enhanced by the use of fluted aluminum sheets and porcelainized enamel as exterior covering for the 120-ft high main boiler building and parts of the connected warehouse, machine shop, and office building. Heralded at dedication ceremonies as another landmark for the area, the plant's 450-ft high stack stands near Morro Rock, a mound of stone rising 576-ft from the bay. It was sighted by Cortez in 1542.

New Group Organized To Push Alaska Hydro

The Central Alaska Power Association has been incorporated at Anchorage, Alaska, to further hydro development in the area.

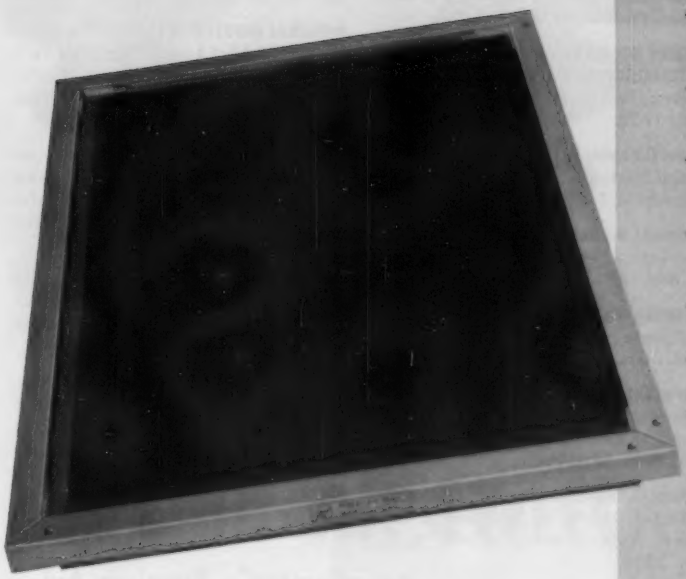
First project of the association is expected to be the development of Cooper Lake. The Kenai Lake unit has requested a $500,000 loan from the Rural Electrification Association to start the project with an installed capacity of 12,200 kw.

An official of the U. S. Geological Survey recently told the sixth Alaska Science Conference at Fairbanks that four lakes on the Kenai peninsula could provide enough head to generate 14,000 kw.

Charter members of the new association are Homer Electric, Matanuska Electric, Chugach Electric, and Kenai Lake Electric Associations. They serve some 12,000 customers in the Kenai-Anchorage-Matanuska area of Alaska.

APC Proceedings Ready

The American Power Conference has recently announced that copies of the official proceedings of its 1955 Conference are now ready for mailing. Copies can be obtained by writing to Dr R. A. Budenholzer, Director, American Power Conference, Technology Center, Chicago 16, Ill. Price $6.



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Sales Feature . . . **Uniform Heat**

The entire surface of our panel radiates heat.

Sales Feature . . . **Economy**

Efficiency up to 80% means minimum operating cost—makes electrical heating practical for large areas.

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No glowing wires or coils—and there's no water needed. PYREX brand glass is strong.

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Corning panels don't attract dust—have no combustion waste.

Sales Feature . . . **Comfort Control**

Each room can have the amount of heat it needs right to the degree.

Sales Feature . . . **Fast Heat**

Corning panels radiate infrared rays that convert to warmth fast.

Sales Feature . . . **Silence**

No moving parts.

Sales Feature . . . **Space Saving**

A complete unit need be only 2 or 3 inches deep.

Sales Feature . . . **Easy Installation**

You can design heaters with Corning Radiant Panels for installation with no complicated wiring or wall preparation.

Sales Feature . . . **Pre-Acceptance**

Consumers know that the PYREX trade-mark identifies dependable value. This helps you gain high acceptance with a new product — right from the start—with consumers, dealers, distributors.

PYREX E-C panel's sales features are helping to create wider acceptance for electric heating

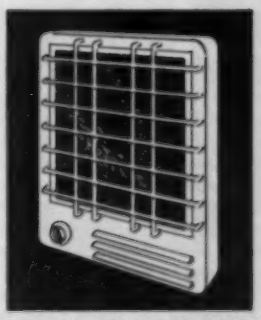
Take all the reasons for having electric heat. Add to them the sales features of the PYREX E-C panel.

You'll have a doubly-impressive collection of features to build demand for electric heat installations in new homes . . . additions . . . expansions . . . auxiliary heating . . . emergency heating . . . and portable heating.

The PYREX E-C panels supply the sales edge in the way they perform. We make them of a PYREX brand glass with a conductive, metal oxide coating bonded to the back surface. They emit infrared energy with a high degree of efficiency. They're mechanically strong and thermally rugged. And their electrical characteristics are excellent. They can be used as high temperature, 2,000- and 3,000-watt units for permanent space-heating installations. Also current surge on starting is low.

To learn all about Corning PYREX E-C Panels and how you can use them to increase the use of electric heating, write, wire or phone Corning Glass Works.

If you are interested in using these PYREX E-C panels as components in new heaters, we'd be delighted to talk it over with you.



Standard panel sizes: 8" x 36", 12" x 16" and 16" x 24" are available. Other sizes to order.

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28 Crystal Street

Corning means research in Glass

MEETINGS CALENDAR

An extended list of coming meetings appears in the last issue of each month

AUGUST

SOUTHEASTERN ELECTRIC EXCHANGE—Personnel Administration Section, Roanoke Hotel, Roanoke, Va., Aug. 11-12.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Pacific General Meeting, Butte, Mont., Aug. 15-18.

STANFORD RESEARCH INSTITUTE—Symposium on Electronics in Automatic Production, Sheraton-Palace Hotel, San Francisco, August 22-23.

WEST COAST ELECTRONIC MANUFACTURERS' ASSOCIATION—1955 Wescon Show, Fairmount Hotel, San Francisco, August 24-26.

SEPTEMBER

SECOND WESTERN AREA DEVELOPMENT CONFERENCE—Sponsored jointly by Stanford Research Institute, the American Industrial Development Council and the Pacific Northwest Trade Association, Multnomah Hotel, Portland, Ore., Sept. 8-9.

ROCKY MOUNTAIN ELECTRICAL LEAGUE—Annual Fall Convention, Grand Teton Lodge, Jackson Hole, Wyoming, Sept. 11-14.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—2nd Electrical Conference of the Petroleum Industry, Shamrock Hotel, Houston, Tex., Sept. 12-14; Industrial Electronics Conference, Rackham Memorial Auditorium, Detroit, Sept. 28-29.

ILLUMINATING ENGINEERING SOCIETY—National Technical Conference, Cleveland, Sept. 12-16.

INSTRUMENT SOCIETY OF AMERICA—10th Annual Conference and Exhibit, Shrine Exposition Hall and Shrine Auditorium, Los Angeles, Sept. 12-16.

EDISON ELECTRIC INSTITUTE—Accounting Division Organization Meeting with American Gas Association, Netherlands Plaza Hotel, Cincinnati, Sept. 13-14; Home Service Committee Meetings, Detroit, Mich., Sept. 14; Industrial Relations Round Table Conference, Drake Hotel, Chicago, Sept. 19-21; Industrial Power and Heating Group, EEI Headquarters, New York, Sept. 22-23; Purchasing and Stores Committee, EEI Headquarters, New York, Sept. 26; Transmission and Distribution Committee, Jung Hotel, New Orleans, Sept. 29-30.

ASSOCIATION FOR COMPUTING MACHINERY—Annual Meeting, University of Pennsylvania, Sept. 14-16.

PUBLIC UTILITIES ASSOCIATION OF THE VIRGINIAS—37th Annual Meeting, Greenbrier Hotel, White Sulphur Springs, West Va., Sept. 15-18.

SYMPOSIUM OF ELECTRONIC AUTOMATION—University of Pennsylvania, Irvine Auditorium, Philadelphia, Sept. 19-20.

SOCIETY OF INDUSTRIAL PACKAGING AND MATERIALS ENGINEERS—10th Anniversary Meeting, Kingsbridge Armory, New York, Sept. 19-22.

PENNSYLVANIA ELECTRIC ASSOCIATION—Annual Meeting, Benjamin Franklin Hotel, Philadelphia, Sept. 20-21.

NATIONAL INDUSTRIAL CONFERENCE BOARD—Marketing Meeting, Waldorf-Astoria Hotel, New York, Sept. 21-23.

MISSOURI VALLEY ELECTRIC ASSOCIATION—Accounting Conference, President Hotel, Kansas City, Mo., Sept. 22-23.

SOUTHEASTERN ELECTRIC EXCHANGE—Engineering & Operation Section, and Subcommittee Meetings, Charlotte Hotel, Charlotte, N. C., Sept. 22-23.

NATIONAL ASSOCIATION OF ELECTRICAL DISTRIBUTORS—Pacific Zone, Annual Convention, Empress Hotel, Victoria, B. C., Sept. 25-28.

SYMPOSIUM ON ELECTRONIC AUTOMATION—University of Pennsylvania, Irvine Auditorium, Philadelphia, Sept. 26-27.

ATOMIC INDUSTRIAL FORUM, INC—1st Trade Fair, Sheraton-Park Hotel, Washington, D. C., Sept. 26-30.

STANDARDS ENGINEERS SOCIETY—4th Annual Meeting, Hotel Statler, Hartford, Conn., Sept. 29-Oct. 1.

OCTOBER

EDISON ELECTRIC INSTITUTE—Meter and Service Committee, Hotel Syracuse, Syracuse, N. Y., Oct. 3-5; Prime Movers Committee, Hotel Cleveland, Cleveland, Ohio, Oct. 3-5; Electrical Equipment Committee, Shoreham Hotel, Washington, Oct. 17-18.

NATIONAL ELECTRONICS CONFERENCE, INC—Hotel Sherman, Chicago, Oct. 3-5.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Fall General Meeting, Morrison Hotel, Chicago, Oct. 3-7.

PUBLIC INFORMATION PROGRAM—Workshop Conference, Chase-Park Plaza Hotels, St. Louis, Mo., Oct. 5-7.

MISSOURI VALLEY ELECTRIC ASSOCIATION—Sales & Rural Conference, President Hotel, Kansas City, Mo., Oct. 5-7.

CANADIAN ELECTRICAL MANUFACTURERS ASSOCIATION—11th Annual Meeting, Sheraton-Brock Hotel, Niagara Falls, Ontario, Canada, Oct. 5-7.

OKLAHOMA UTILITIES ASSOCIATION—Accounting Section, Lawton, Okla., Oct. 14.

NATIONAL INDUSTRIAL CONFERENCE—Board Meeting, Waldorf-Astoria Hotel, New York, Oct. 20; Special Atomic Energy Conference, Waldorf-Astoria Hotel, New York, Oct. 26-28.

SOUTHEASTERN ELECTRIC EXCHANGE—Accounting Conference, Hotel San Carlos, Pensacola, Fla., Oct. 20-21; Sales Conference, Biltmore Hotel, Atlanta, Ga., Oct. 27-28.

NATIONAL ASSOCIATION OF RAILROAD AND UTILITIES COMMISSIONERS—67th Annual Convention, Grove Park Inn, Asheville, N. C., Oct. 24-27.

PENNSYLVANIA ELECTRIC ASSOCIATION—Electrical Equipment Committee, Hotel New Yorker, N. Y., Oct. 27-28; Relay Committee, Pocono Manor Inn, Pocono Manor, Pa. Oct. 31-Nov. 1.

Kaiser Co Promises Aid On PUD's Hydro Project

The Douglas County PUD of Bridgeport, Wash., has obtained a promise of help from the Kaiser Aluminum Co in its investigation of proposed construction of a hydroelectric dam across the Columbia River at the Wells site, 30 mi downstream from Chief Joseph Dam.

Provided the PUD receives confirmation of its preliminary permit from the FPC for the dam, Kaiser will carry out preliminary engineering studies in conjunction with the PUD and prepare a construction cost estimate, said George Hamilton, PUD representative.

If studies establish feasibility of the project, the PUD will apply for a license to finance and build the project. Kaiser will consider the establishment of new aluminum-reduction facilities in the county "if investigation shows the Wells site can produce power at prices which will make aluminum production there competitive," said Norman Krey, Kaiser's northwest operations manager.

Kaiser also is studying a proposal to build a dam upstream at Arrow Lakes in British Columbia.

Rugged construction of high pressure rear contact.

Front contact in open position.

NEW 3E SIDE BREAK SWITCH

THE BF-20

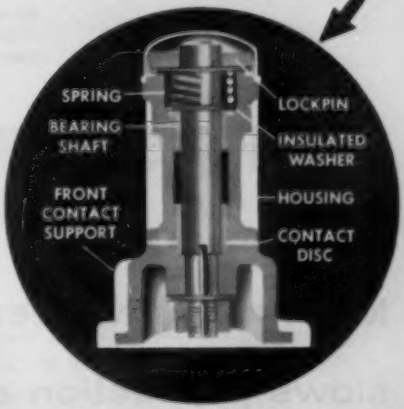
A completely new switch, with many advanced features that make it the best buy in low cost, outdoor switchgear . . . and its long life is assured by sound design, a minimum of parts, and extra heavy construction. Typical of the quality products that have established Three-E's reputation.

When you need a side break switch,

CHECK FOR THESE MODERN FEATURES

1. **Simple, rugged design.**
2. **High pressure silver contacts, braidless for longer life.**
3. **Toggle motion, positive ice breaking and wiping action.**
4. **The switch can be assembled for right or left hand operation, with the same components.**

Available through 161 KV, 600 Amp and 1200 Amp.



THREE E

3E

The current travels through the front contact bearing unit, which rotates to give the toggle action, and is transferred to the support at the silver contact disc. An insulated low stressed, stainless steel coil spring keeps the two parts under high pressure contact at all times.

Write for new bulletin 335.

ELECTRICAL ENGINEERS EQUIPMENT CO., MELROSE PARK, ILLINOIS

INFORM-A-FACTS ANACONDA

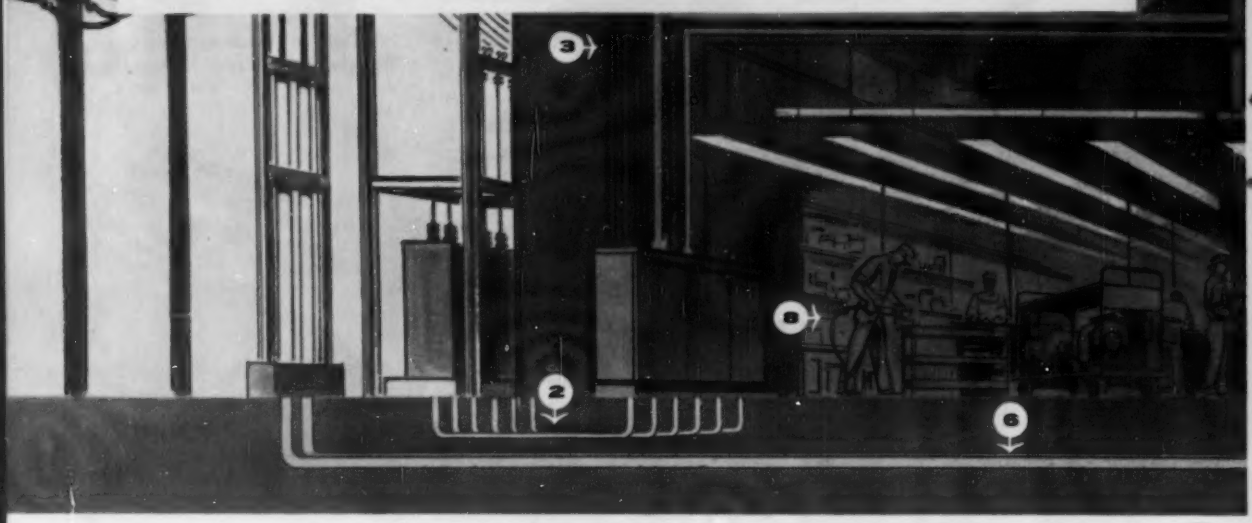
ANACONDA
WIRE & CABLE COMPANY

TO: UTILITY POWER SALES DEPT.
SUBJECT: OBSOLETE INDUSTRIAL WIRING
REFERRING TO: 4-PAGE ADVERTISEMENT

The entire electrical industry has been talking about adequate wiring. But, as you know, there's still another big story to register with industrial customers.

It's the fact that most industrial wiring today is obsolete.

As a part of Anaconda's contribution to your continuing efforts, this 4-page advertisement has been published in leading business and trade publications. Earlier you remember Anaconda's "Industrial Mechanization," "Preventive Maintenance," "Wire Ahead" and "Power Up" campaigns.

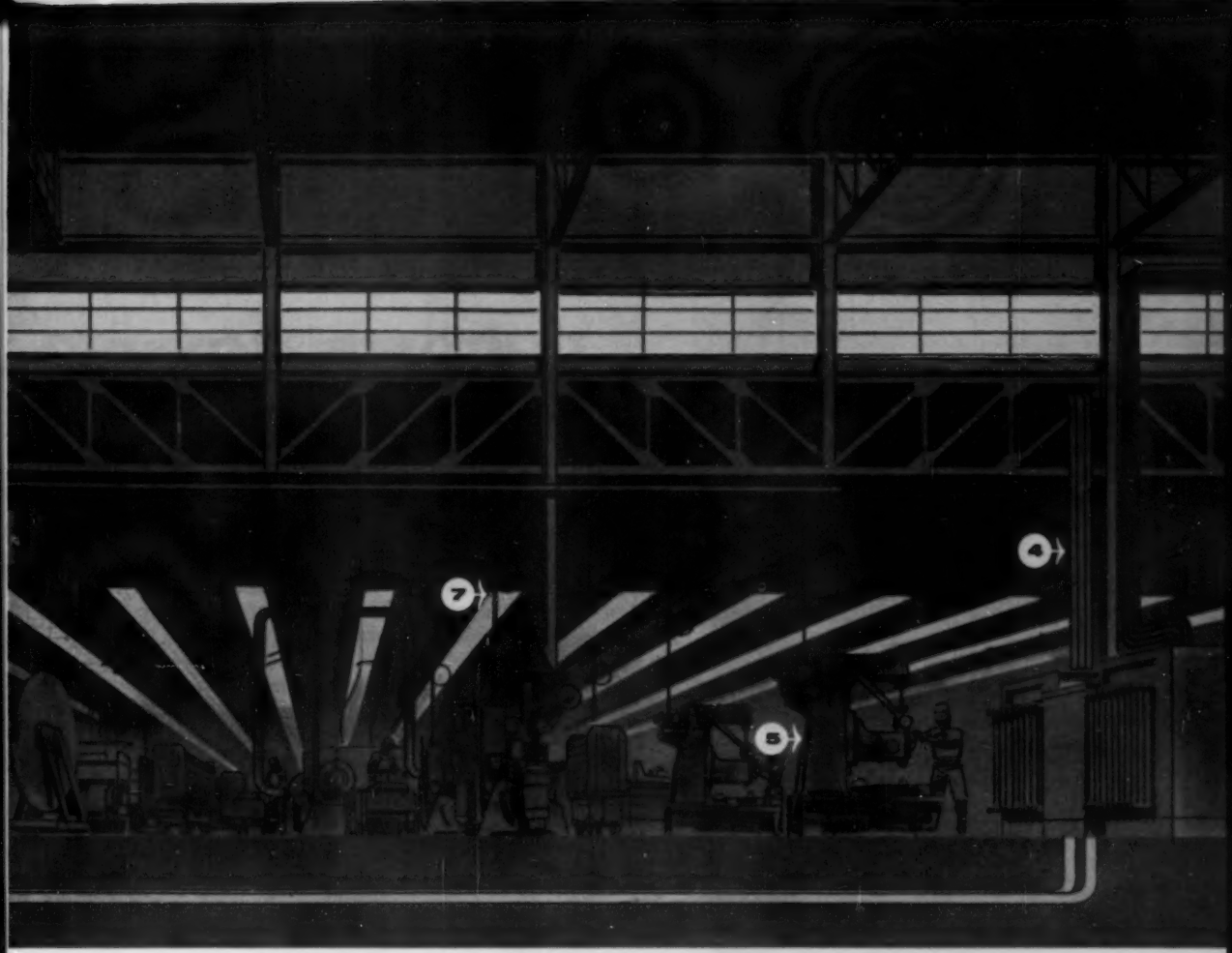


All around the plant, modern Anaconda wires and cables help industry reap the benefits of more efficient power, greater reliability, and long-range economy. Read on the following page the exciting facts about 1) new Aerial Cable, 2) new AHW moisture-resistant cable,

IT'S TIME TO TAKE A

Most manufacturers know inadequate plant wiring slows production and skyrockets costs.

But wiring can be adequate and still waste money—because it's obsolete! Here from Anaconda are the facts on what you can do to make your wiring as up-to-date as the rest of your operations.



3) rugged, corrosion-free Durasheath neoprene-jacketed cable used as feeders, 4) low-cost Interlocked Armor Cable, 5) new Control Cables, 6) ozone-resistant Butyl insulation for high-voltage cable, 7) Powerduct flexible busduct cable that increases the efficiency of busway systems, and 8) portable cords.

NEW LOOK AT WIRING!

Plant wiring today has become a major concern for management everywhere.

The reasons are easy to see. Shifting plant requirements, new tools, new materials, new handling procedures—*all* the great changes in modern industry are bringing with them special problems in power.

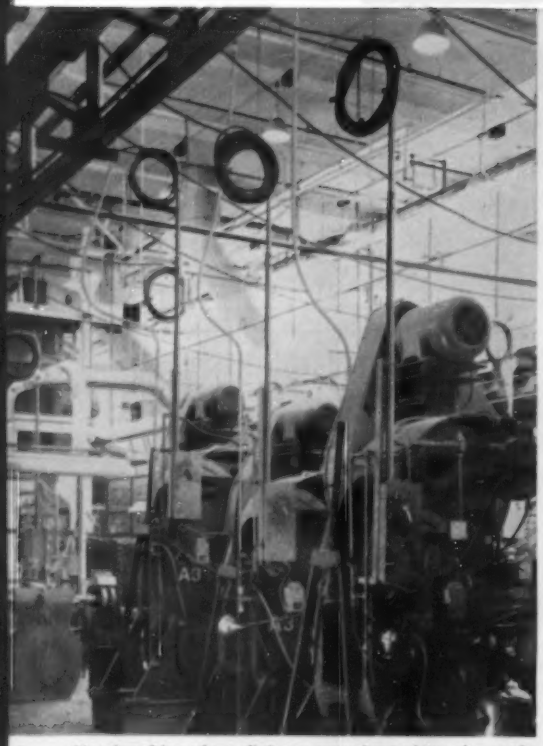
How these problems are solved has a direct bearing on your profit picture.

Since most plants were built — including some only a few years old—vast advancements in wires and power cables have taken place.

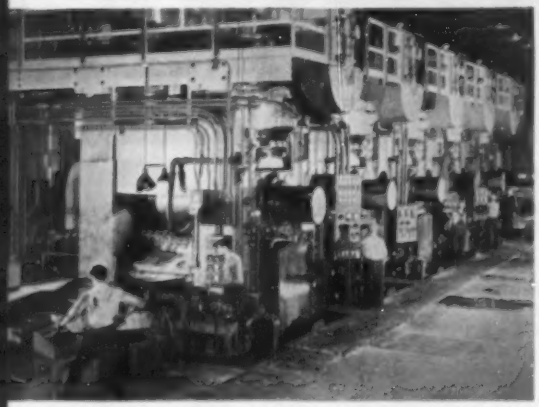
For example — new, thinner insulations today squeeze more capacity from existing conduit. New heat-resistant compounds boost wire current-carrying capacity. Tough new jacketing materials increase cable life. New cable designs enable manufacturers to find even more jobs for low-cost, efficient electric power.

Top management has a big stake in seeing that plant wiring is up-to-date. Though you must rely upon the knowledge and experience of qualified electrical experts when wiring up, acquaintance with modern industrial wires and cables will help you guide your company to sound decisions.

TURN THE PAGE AND SEE WHAT MODERN WIRING CAN DO FOR YOU



Metalworking plant eliminates expensive rewiring when equipment must be moved—by using *flexible* Anaconda **Powerduct Cable** from busduct to machine.



Steel Mill uses thousands of feet of Anaconda **Control Cable.** Modern insulations and jackets give most reliable service ever where there's heat and moisture.

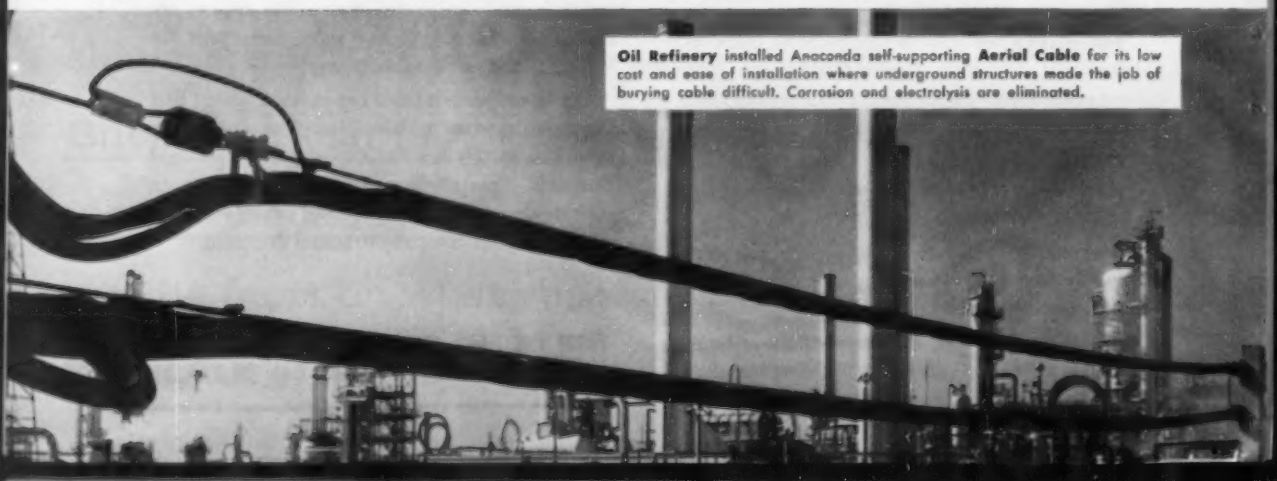
IT'S TIME TO TAKE A NEW LOOK

7 ways modern costs down,

The nerve-system of your plant is its electric wires and cables. And now – with new production and operating factors in the picture – it's time for a basic survey. If they're obsolete, it will pay you to replace them . . . with new, more efficient, more economical ones.

Modern wiring has seen a wealth of new developments. Let's take a quick look at 7 of the most important of these *in light of changes that have probably taken place in your plant* since the original wiring was installed.

1. **NEW HIGHER VOLTAGES.** The trend to higher plant voltages – with its resulting savings in cable costs and line losses – poses a new problem: ozone, a by-product of high voltage, destroys ordinary insulation . . . and causes premature cable failure. Anaconda engineers have solved this problem with pioneering work in new *butyl* rubber. It has *inherent* resistance to ozone. Higher voltage (and ANACONDA butyl-insulated power cables) ought to come high on your list of cost-cutting ideas to talk over with your electrical department or contractor.
2. **NEW CABLE HAZARDS.** Chemicals, moisture, oil – natural to most modern plants – are tough on cable. Engineers at Anaconda have come up with an answer: Durasheath* rubber-insulated, neoprene-jacketed cable for all voltages. This rugged cable resists almost *every* enemy of cable life. Use it everywhere – aerially, in ducts, or buried directly in the ground – you'll find it reduces downtime, maintenance and replacement costs.
3. **NEW OPERATING CONDITIONS** put new demand upon wiring. Higher loads generate higher heat in cable . . . and more heat in cable installed underground or in other



Oil Refinery installed Anaconda self-supporting **Aerial Cable** for its low cost and ease of installation where underground structures made the job of burying cable difficult. Corrosion and electrolysis are eliminated.

AT WIRING!

wiring keeps production high

moist locations is tough on cable insulation. Today, AHW rubber insulation, used on many ANACONDA rubber power cables, does the best job ever in withstanding *heat and moisture together* at 80C operating temperature.

4. **NEW EQUIPMENT.** The addition of process-heating equipment, process or comfort air conditioning, or new production machines calls for more wiring to carry the load. ANACONDA Interlocked-Armor Cable can be installed up to 40% quicker than many other types of cable because it needs no conduit. You save time and money when the cable is installed – and later, too, if cable must be moved.
5. **MODERN BUSWAY SYSTEMS.** Today you can *increase* the flexibility of your busways – with Anaconda's flexible Powerduct* Cable. It just plugs into the busduct . . . and unplugs when you want to move machines. There's no costly conduit to put up or rip out. And the cable is 100% salvageable on every move!
6. **NEW POWER.** When additional power is needed, ANACONDA Aerial Cable is today's popular choice for the job, especially where the ground is packed with pipes and other structures or contains corrosive agents. It is fast, easy to install even between closely spaced buildings where clearance is limited. It's neat, safe, lower in cost than underground systems, and gives highest *reliability.*
7. **NEW ELECTRIC EQUIPMENT.** The trend to automation and more complex machines puts new emphasis on control cable. The job cannot be left up to cable whose performance is just "so-so." Anaconda's years of cable experience has paid off in a new full line of control cables – with modern types of insulations and coverings to give them highest reliability. These cables assure you the best possible service from your new equipment.

This advertisement provides only a few examples of how modern Anaconda wires and cables help industry wire up for more economical, more efficient production. Your electrical department or electrical contractor can give you personal and expert assistance with your needs.

*Reg. U. S. Pat. Off. 88314

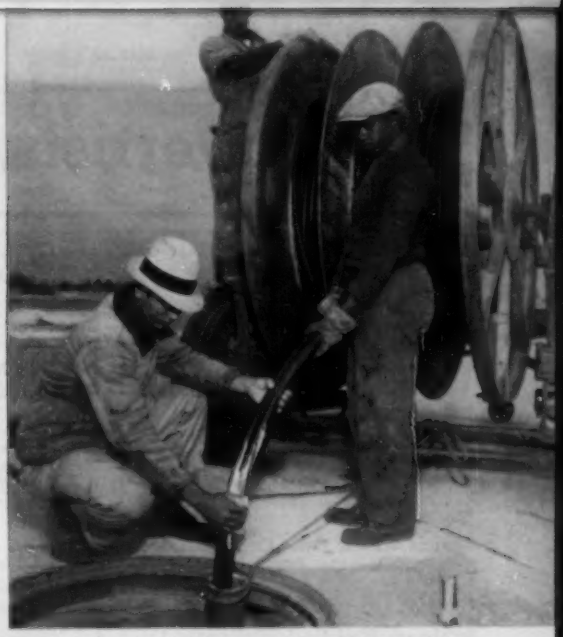
see the man from

ANACONDA®

about your

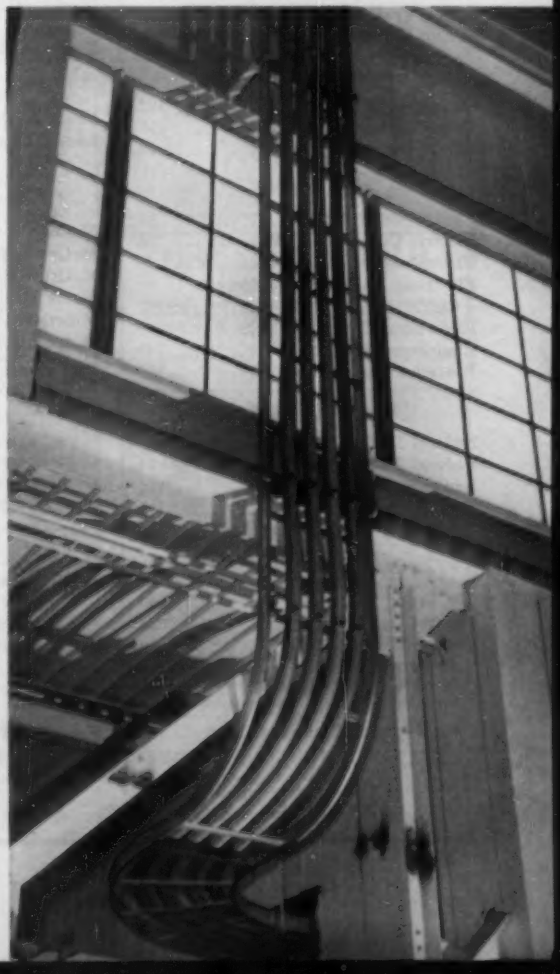
POWER CABLES

ANACONDA WIRE & CABLE COMPANY,
25 BROADWAY, NEW YORK 4, NEW YORK



Chemical plant installed thousands of feet of Anaconda **Duro-sheath Cable** for power and lighting. Rugged neoprene jacket resists heat, moisture, acids and alkalies.

Assembly plant reaped high-cost savings by installing flexible, quickly placed Anaconda **Interlocked-Armor Cable** from unit substation.



Advertising In This Issue

Acker Drill Co., Inc. 164
Air Preheater Corp., The 54
Allis-Chalmers Mfg. Co. ..... 2nd Cover
34, 35, 52, 53, 106, 107, 117
123, 150, 151
American Chain & Cable, Wire Rope Sling Dept. 195
American Telephone & Telegraph Co. 175
Anaconda Wire & Cable Co. 182
183, 184, 185
Ansonia Wire & Cable Co. 162
Automatic Nut Co., Inc. 145

Bethlehem Steel Co. 171
Blackburn Corp., Jasper 31
Bristol Company 165

Chance Co., A. B. 121, 125
Cole Electric Co. 200
Cope Inc., T. J. 147
Copperweld Steel Co. 143
Corning Glass Works 179

Directory of Engineers 187
Dow Chemical Co., The 197
Driver-Harris Co. 18

Ebasco Services, Inc. 39
Electric Controller & Mfg. Co. 38
Electric Service Mfg. Co. 26, 27
Electrical Engineers Equipment Co. 181
Electroline Company 5
Engineers Directory of 187
Everstick Anchor Co. 122

Federal Pacific Electric Co. ..... 3rd Cover
Federal Telephone & Radio Co. 24
Ferranti, Ltd. 115
Flint Steel Corp. 116
Foushee & Heckendorn 170

Gar Wood Industries, Inc. 160
General Cable Corp. 23
General Electric Co.
Apparatus Dept. 42, 43, 89, 90
91, 92, 94, 95, 96, 98, 99, 101
102, 103, 148, 172, 173
Construction Materials Div. 166
167
Globe Co., The 114
Green Fuel Economizer Co., Inc. 45
Greenlee Tool Co. 148
Grip-Tite Mfg. Co., Inc. 170
Gulf Oil Corp. 36

Hazard Insulated Wire Works 4
Homelite Corp. 14

I-T-E Circuit Breaker Co., R&IE Equipment Div. 41
I-T-E Circuit Breaker Co., Switchgear Div. 11
Indiana Steel & Wire Co. 152

Kearney Corp., James R. 33
Keasbey & Mattison Co. 193
Kellogg Co., The M. W. 153
Kennecott Copper Corp. 158, 159
Kimble Glass Co., Sub. Owens-Illinois 30
Kuhlman Electric Co. ..... 4th Cover

Leeds & Northrup Co. 161
Locke Dept. General Electric Co. 118, 119

Mallory & Co., Inc., P. R. 50
McGraw-Hill Book Co. 176
McGraw-Hill Pub. Co., Inc. 154, 155
Meter Devices Co. 170
Minerallac Electric Co. 164
Minnesota Mining & Mfg. Co. 163
Moloney Electric Co. 55, 56, 126, 127
Monsanto Chemical Co. 49

Ohio Brass Co. 109, 110, 111, 112
Okonite Co., The 4
Orangeburg Mfg. Co., Inc. 40

Pacific Coast Engineering Company 51
Page Fence Ass'n. 114
Pennsylvania Transformer Co. 19
20, 21, 22
Phelps Dodge Copper Products Corp. 28
Porcelain Products Inc. 156
Preformed Line Products Co. 113

Revere Copper & Brass, Inc. 105
Riley Stoker Corp. 12, 13
Roebling's Sons Corp., John A. 149
Royal Electric Mfg. Co. 124

S&C Electric Co. 6, 7
Sangamo Electric Co. 9, 10
Searchlight Section 188, 189
Sierra Electronic Corp. 146
Simplex Wire & Cable Co. 8
Smith Co., S. Morgan 32
Socony Mobil Oil Co., Inc. 15
Sorgel Electric Co. 48
Southern States Equipment Corp. 25
Square D Co. 37
Sylvania Electric Products, Inc. 157, 191
Syntrol Designs 164

Thiel Tool & Engineering Co., Inc. 162

United States Rubber Co. 44

Wagner Electric Corp. 16, 17
Westinghouse Electric Corp. 29
46, 47, 129, 130, 131, 132, 133, 134
135, 136, 137, 138, 139, 140
Wheeler Reflector Co. 177

■

PROFESSIONAL SERVICES 187

■

CLASSIFIED ADVERTISING
F. J. Eberle, Ass't. Mgr.

EMPLOYMENT OPPORTUNITIES 188

EQUIPMENT
(Used or Surplus New)
For Sale 189

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Applicants should give full details concerning education, experience, and salary expected. Further information concerning the City will be furnished to applicants upon request.

Address applications or requests for information to

Philip L. White, City Manager

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POSITIONS VACANT

Distribution Engineers—Two competent graduate electrical engineers, age 30 to 40, with minimum 8 years experience design, operation and maintenance of distribution of facilities, required by rapidly growing utility, desirable location South America, Portuguese or Spanish useful—not essential to start. Reply stating age, education, experience, personal particulars and minimum salary expected. P-7269, Electrical World.

Electrical Engineers—Power Major—Several assistants and juniors—assistants minimum 5 years experience—juniors 2 to 3 years experience in electrical design, operation and construction of steam, diesel, hydro, electric plants and substations. Permanent position with long established consulting organization for public utility operating companies located Latin America. Headquarters New York. Some travel necessary in future. Knowledge of Spanish or Portuguese useful—not essential. Salary commensurate with qualifications. Good opportunity. Reply stating age, education, experience, personal particulars, and minimum salary expected. P-7270, Electrical World.

New Hampshire Utility has openings for graduate Electrical Engineers, experienced in Distribution, transmission, and substation work. Thirty-five years of age or less. Applicants with at least five years of experience preferred. Reply stating age, personal particulars, education, experience and minimum salary expected. P-7265, Electrical World.

EMPLOYMENT SERVICE

Salaried Positions $5,000 to $35,000. We offer the original personal employment service (established 45 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 658 Brisbane Bldg., Buffalo, N. Y.

POSITIONS WANTED

Electrical Engineer, B.E.E., 27 years experience in transmission and distribution operation, construction, and maintenance. 14 years as supervisor. Desire responsible position with electric utility or industrial plant. Registered professional. Member A.I.E.E. Location immaterial. PW-6786, Electrical World.

21 years utility experience engineering and operation of gas, electric, steam systems. 48, married, family. Manager of engineering, operation, transportation. AIEE, NSPE, ASME. Registered. BSEE, Litt. M. degrees. Retired naval officer. Desire change. Prefer east, southeast. PW-6833, Electrical World.

POWER ENGINEER

Wanted graduate mechanical or electrical engineer with no more than 3-4 years' experience in steam electric generating plant, hydraulics, refrigeration, instrumentation, and lubrication engineering.

Will assist in planning, design and direction of 14 boilers, 18 mm. lbs.-a-day steam plant, 15,000 k.w. generating plant and 22,000 k.w. electric distribution system.

Excellent working conditions. Located in city of 70,000. Liberal company benefits. Five day, forty hour week. Please send complete resume to Personnel Department.

A. E. STALEY MFG. CO.
DECATUR, ILL.

ELECTRICAL ENGINEER

. . . to operate large A-C Network Calculator. Must be experienced in system planning and power system analysis. Salary open. Write to Personnel Director.

THE FRANKLIN INSTITUTE
20th & Parkway **Phila. 3, Pa.**

GRADUATE ELECTRICAL ENGINEER

Experienced in industrial lighting with some power plant background. Age under 40. To arrange for an interview, please forward your resume to Mr. Garvey.

GIBBS & HILL, Inc.
461 Eighth Ave. New York 1, NY

SALES REPRESENTATIVE WANTED

Leading manufacturer of complete line commercial and industrial lighting equipment has territory open in Milwaukee and Northern Wisconsin. Excellent business opportunity for top calibre salesman presently calling on architects, engineers, electrical distributors and contractors. Send complete resume to: Sales Manager, The Miller Company, Meriden, Connecticut. All replies strictly confidential.

SALES REPRESENTATIVES WANTED

Leading manufacturer of complete line commercial and industrial lighting equipment has territories open in Louisiana, South Carolina and Virginia. Excellent business opportunity for top caliber salesmen presently calling on architects, engineers, electrical distributors and contractors. Send complete resume. All replies strictly confidential. Write

RW-7180, Electrical World
330 W. 42 St., New York 36, N. Y.

Your Inquiries to Advertisers Will Have Special Value . . .

—for you—the advertiser—and the publisher, if you mention this publication. Advertisers value highly this evidence of the publication you read. Satisfied advertisers enable the publisher to secure more advertisers and—more advertisers mean more information on more products or better service—more value—to YOU.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

UNDISPLAYED RATE:

$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.50 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is $14.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

Send NEW ADVERTISEMENTS to N. Y. Office, 330 W. 42nd St., N. Y. 36, N. Y. for August 22nd issue closing August 12th

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1111 Wilshire Blvd. (17)

PERIODICALS

A.I.E.E. transactions back-volume wanted to buy for cash. Ashley, 24 E. 21, N.Y.C. (10).

PLANTS & PROPERTIES

For Sale. Brick building app. 42x128 on corner lot, front half two story suitable for clinic, grocery store, lodge hall, apartments, garage and show room, general store, new furnace modern structure. Bids will be received up to September 16th 1955 with right to accept or reject all bids. Presently occupied by owners. Lorain Medina Rural Electric Cooperative, 224 N. Main St., Wellington, Ohio.

GENERATOR
Fairbanks-Morse Co.

1875 KVA 1500 KW 300 RPM
3 phase 60 cycle 2400 volt

Single Bearing direct connected Exciter
Formerly connected to 10 cyl Model 35E16

In Good Condition

PRICE: $5,000.00

A. G. SCHOONMAKER COMPANY, INC.
P. O. Box 516 Sausalito, California

FOR SALE
3—250 KVA Maloney Type C TRANSFORMERS
2400—120-240 volt.
KROEHLER MFG. CO.
Naperville, Illinois

Specialist for 47 Years in—

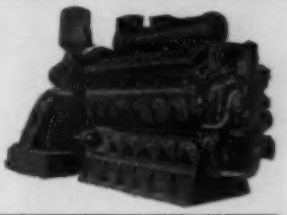
LARGE POWER EQUIPMENT

Do you receive our stock list? Prompt shipment from inventory. A.C. & D.C. Motors, Transformers, M-G Sets, Frequency Changers, Controls, Turbo-Generators and Circuit Breakers. Attractive prices for rebuilt-guaranteed equipment. Contact us before purchasing.

BELYEA COMPANY, INC.
51 Howell St. Jersey City 6, N. J.

DIESEL POWER

IMMEDIATE SHIPMENT
• PURCHASE OR RENTAL
UNIT CAPACITIES—10 TO 2475 KVA
A.C.—50 AND 60 CYCLES
• ALSO D.C. UNITS



A PARTIAL LISTING OF OUR INVENTORY

KW	MAKE	Model	HP	RPM
1180	Worthington	SEH-8	1685	360
1136	Fairbanks Morse	38D	1600	720
1100	General Motors	16-278A	1600	720
1000	General Motors	16-567B	1440	720
750	General Motors	12-567	1080	720
700	Worthington	EE-8	1000	327
675	Fairbanks Morse	38D	960	720
500	General Motors	8-567	720	720
500	Alco	6-12½13T	750	600
280	Baldwin	VO-6	510	450
220	Enterprise	DSG-6	460	450

KW	Make	Model	HP	RPM
320	Superior	6GE-6	480	450
300	Fairbanks Morse	32E14	450	300
300	General Motors	8-268A	450	1200
250	Clark	GD-6	375	360
200	General Motors	6-268A	300	900
175	General Motors	12-71	275	1800
150	Buckeye	80	240	600
148	Fairbanks Morse	32E14	220	300
100	General Motors	3-268A	150	1200
60	General Motors	6-71	90	1200

A. G. SCHOONMAKER COMPANY, INC.
DIESEL DIVISION, 50-52 CHURCH ST., NEW YORK 7, N. Y.

ELECTRICAL WIRE AND CABLE
—YOUR BEST SOURCE—
• for every industrial and power application
• Odd lengths—long and short—reasonably priced

One of the Largest Stocks in the Midwest

Let us quote on requirements—
send your inquiries
We'll also buy your Surplus
Branch Offices:
Houston—Walnut 3-4580 Los Angeles—ANgeles 3-5148
FOR YOUR TEMPORARY NEEDS TRY OUR SURPLUS DIVISION

UNIVERSAL Wire and Cable Co.
2664M N. Clybourn Ave., Chicago 14, Ill.
EAstgate 7-4777 Code: UNIWIRE

MOTOR GENERATOR SETS

KW	MAKE	A.C.	D.C.
1000	G.E.	13200	600
500	Westg.	2300	250
400	Al.-Ch.	2300	1150/240
400	G.E.	2300	230
300	G.E.	2300	230
300	G.E.	2300	250
300	Westg.	2300	1150/275
200	Westg.	4160/2300	275
200	Ridgeway	2300	230
170	G.E.	440	125
150	Al.-Ch.	2300	275
150	Westg.	2300	1150/250
150	G.E.	440	275
100	G.E.	2300	250
100	Westg.	440	125
100	G.E.	440	125
75	Al.-Ch.	440	250
75	G.E.	440	125

CHICAGO ELECTRIC CO.
1324 W. Cermak Rd. Chicago 8, Ill.

TRANSFORMERS

FOR SALE

3—1000 Kva Mol. 11500-2400/4160Y
3— 500 Kva G-E 22000-2300/4000Y
5— 333 KVA W-H 38000-7200/12470Y
3— 333 KVA G-E 33000-2300/4000Y/6900/11950Y
3— 333 Kva Wagner 6900/11950Y-7200/12470Y
3— 250 Kva G-E 3415/2300-600
6— 200 KVA G-E 13200-2400/2300
6— 200 KVA G-E 13200-230/460
3— 167 KVA W-H 13200-2400/4160Y
3— 167 KVA Wagner 2400-600

Many other items in stock.

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
5316 Hetzel St.
Cincinnati 27, Ohio

40 Years' Dependable Service

Somebody—Somewhere,
needs your idle equipment! Reach that buyer quickly and economically thru the
"SEARCHLIGHT SECTION"
The meeting place of Used Equipment Buyers and Sellers

Match Ad Competition Opens

Entries currently are being accepted from electrical utilities, equipment manufacturers, and other industry divisions for the competition in match book advertising. The Match Industry Information Bureau, 500 Fifth Avenue, New York City, runs the competition annually. Closing date for receipt of entries is September 1.

"Joshua" plaque awards—named for match book inventor Joshua Pusey—will be awarded in each of 46 industrial classifications. The awards will be based on effectiveness of copy, typography, and layout. Judging will be by a panel of leading advertising and marketing experts.

Shown here is Match Industry Information Bureau's Ronda Barnard examining this year's first utility entry, a book from Knoxville Utilities Board, Tenn. The Board used match books to inform employees of the fringe benefits available to them.

Among plaque winners in previous years have been Citizens Utilities Co and Allis Chalmers Manufacturing Co, while such companies as Consolidated Edison of New York, General Electric Co, Okonite Co, and others, have won special certificates.

Pacific P&L Float Wins Prizes

Reddy Kilowatt rides to fame along with trailblazers Meriwether Lewis and William Clark and their Indian maiden guide, Sacajawea. In the territory of Pacific Power & Light Co in the Pacific Northwest states of Wyoming, Montana, Idaho, Washington, and Oregon, community parades these summer days are being enlivened with this float.

The intrepid explorers reached the Pacific shores, via routes in PP&L's territory, 150 years ago and the anniversary has been adapted to the float theme which also keynotes many of the events it helps celebrate.

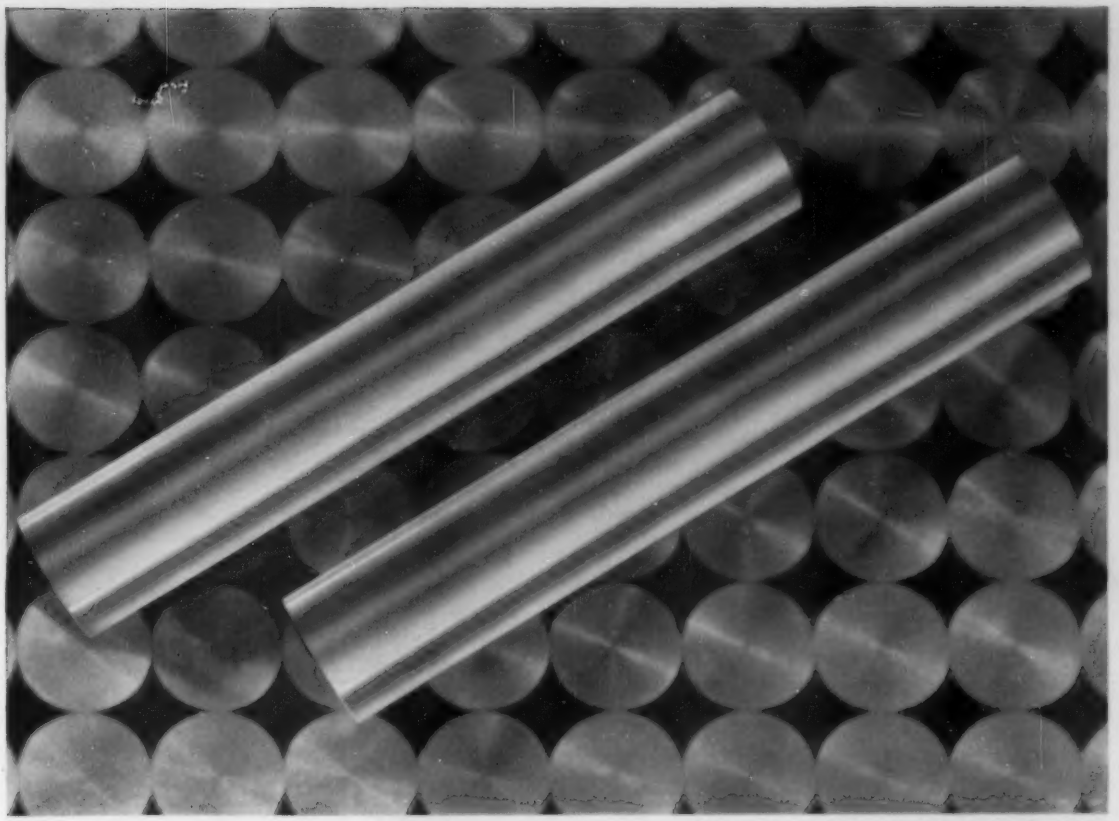
The float has been scheduled for 21 dates, has captured two sweepstakes and two first prizes in the four parades in which it was entered competitively. PP&L has a second float, smaller and on a different theme, to fill dates which conflict with the Lewis & Clark vehicle.

PR&A BRIEFS

• CBS TV and Young America Films announce release, in 16 mm print form, of "You Are There" series on a purchase or rental basis effective September, 1955. Prints can be purchased by anyone. Inquiries can be sent to Young America Films, 18 East 41st St., New York 17, N. Y.

• PUAA announces these new chairmen: Bob Boyd, Columbus & Southern Electric Co, of Advertising Exchange Service; Warren Widenhofer, Indiana & Michigan Electric Co, of the Better Copy Contest; Ray Martin, Consolidated Edison Co, New York, of committee to pick an award winner for private enterprise advertising outside utility industry.

• The Cleveland Electric Illuminating Co is telling the public in full-page ads that it will bring three-wire electric service to any home in its area free of charge if an electric range, dryer, or water heater has been purchased. The cost of this service to the company is between $70 and $90, CEI points out. It notes it is one of "very few utilities" making this offer.



Atomic reactor fuel elements—a few of many thousands produced by Sylvania's nuclear fuel manufacturing facilities, Hicksville, N. Y. Fuel shown ¾ actual size.

10,000 tons of coal . . . 1955 style—

WHEN YOUR PLANNED atomic energy power plant is completed, *reactor fuel* will become as important to your operations as coal, gas or oil is today.

Recognizing this, wise planners in atomic energy are investigating reactor fuel sources *now* . . . discovering that Sylvania has long been a leading producer of nuclear fuel elements and reactor components.

Sylvania's Atomic Energy Division is thoroughly equipped to supply production quantities of standard atomic fuel elements or special designs to meet your particular requirements. In addition, Sylvania will work with you in developing effective, economical fuel reprocessing methods so that your over-all costs will be as low as possible.

If your power or research reactor is still in the planning stage, you are invited to take full advantage of Sylvania's years of pioneering experience in the design and manufacture of atomic fuels and specialized components such as pumps, valves, test loops and reactor control elements. You will benefit from the combined skills and experience of more than a hundred specializing scientists and engineers.

Whether you are operating, planning, or just thinking about power reactors—Sylvania's scientific and engineering staff will gladly discuss your problems with you. For further, detailed information including a descriptive brochure of Sylvania's atomic energy activities, call or write:

SYLVANIA ELECTRIC PRODUCTS INC.
Atomic Energy Division, P. O. Box 59
Dept. 2816, Bayside, New York

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ATOMIC ENERGY DIVISION

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

READERS FORUM

Methodology Might Suggest Terminology

To the Editor:

On page 39 of the May 2 issue the question is posed, "Is 'adequate wiring' too stilted for general use?" Here are some ideas.

We can start out with the premise that the English language is difficult to use to convey everything to all people in a few words.

What is needed perhaps is a thorough analysis of all alternatives, even to the point of setting down on paper all of the considerations which can be brought to mind, and then do an evaluation job. The attached material may suggest a methodology. First is set forth the proposition and some alternatives. Following that, there is an attempt to Pro and Con the existing terminology. More Pros and more Cons can be added, and then the two columns can be evaluated.

Finally there are some comments and suggestions for words which will "give us more mileage."

Proposition

How can we best denote the need for describing electric wiring systems to meet today's electrical living with "room to grow" to accommodate tomorrow's electrical living—and be something which will attract favorable attention and that Mr Homeowner will buy.

Alternates for consideration:

1. Adequate wiring.
2. Use words which will be more rational, logical, natural, or significant.

Analysis of the term, "Adequate Wiring"

Pro

1. It is a "catch phrase."
2. This phrase is of long-standing and gaining understanding and acceptance. It may be difficult to change it now, particularly as a large promotional "campaign" is behind it.
3. It is a timeless phrase—It is always useful and will never wear out.
4. What is really needed is to get all parties at interest solidly behind the program and promote it on an intensive and continuing basis.
5. Adequate Wiring is a program which needs more and more implementation including greater and greater financial support.

Con

1. "Adequate" is related to time and therefore not precisely definitive.
2. "Adequate" carries connotation of opinion. My opinion of what's adequate is entirely different from opinions of others. It is therefore a rather loose word.
3. This phrase has been in use for many years but has not "caught on" well enough to produce desired results.
4. Something more is needed to assure that electric appliances and equipment can be fully used more easily.
5. What does it really do for the industry?
6. We can readily see that inadequate wiring is turning out to be a crumbling keystone to the advance of full electrical living in the home, on the farm, and in industry.
7. "Adequate Wiring" is not universally impressive—does not fully motivate people to do things, ie, to insist that new homes have the forward look in wiring or to take positive steps to modernize wiring installations.

Comments and Suggestions

It would seem that we need to set forth carefully what we are aiming at.

One thought is 1960 or 1970 or 1975 wiring level.

Another (particularly for homes and other dwelling units) is 10,000-kwhr or 25,000-kwhr wiring.

Therefore, some suggestions for words which may "give us more mileage" are:

Forward Look Wiring	1960 Era Wiring
25,000-kwhr Wiring	Full Use Wiring
Long-term Wiring	All-Electric Wiring
New Look Wiring	Electrical Living Wiring
New Era Wiring	Wired for Light, Power & Heat

Wiring for Modern Electrical Living

Wiring for Modern Living Standards

All of these (and other) suggestions can be Proed and Conned and evaluations made of each and from all of such mental gymnastics. Something new and better may emerge. At a minimum there may be some valuable supplementary ideas which will come out.

R. Cutts, Jr.
Consultant-Standards Relations
Engineering Standards Dept

General Electric Co
Schenectady 5, N. Y.

Too Hot To Handle

To the Editor:

In your May 2 edition there was an industrial brief describing heat treating at the Paulo Products Co.

I would like to call your attention to a typographical error. The article reads, "Heat treating metal with flexibility is one of the important characteristics of a 375-kv unit in the commercial heat treating shop of the Paulo Products Co." The copy should have read: "375-kilocycle heat treating unit."

I call this to your attention because you may have inquiries concerning this important difference of 357 kv as compared with 375 kc.

Charles T. Heaton
Industrial Engineer

Union Electric Co of Missouri
St. Louis 1, Mo.

ASBESTOS CORD made by K&M especially for flare parachutes exemplifies high quality of K&M asbestos textiles. Other K&M asbestos cords are used in electric motors, for wire wipers, and for insulation of glass-handling tools.

Nature's "miracle" fiber—tailored to your needs

K&M ASBESTOS TEXTILES

Whether it's used in a fire-fighting suit, spun into cords for parachute flares—woven into cloth, tape or thread for electrical insulation—asbestos serves better than any other material found in nature or devised by man.

Keasbey & Mattison selects the finest grades of asbestos fibers and weaves them into textiles that are recognized for their uniformity of weave and thickness.

K&M has the know-how to tailor-make any special asbestos items you may require—promptly, and with fidelity to specifications. Choose K&M asbestos textiles in any of their varied forms: yarn, roving, thread, tapes, cloth, tubing, wick packing, twisted and braid rope packing, safety garments. They're backed by more than half a century of research and development experience.

We'll gladly help with any insulating problem you may have. Write or call us any time.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

K&M best in asbestos®

In Canada: Atlas Asbestos Company, Limited; Montreal, Toronto, Winnipeg and Vancouver

WASHINGTON COMMENT

Geneva Conference May Change AEC Policy

Reports on nuclear progress in other countries may lead to fewer restrictions on information and greater cooperation by the government with U. S. industry

The International Atomic Energy Conference beginning in Geneva today may result in some basic changes in this country's policies on secrecy, industry participation, and relations with other nations.

That's because U.S. officials and businessmen will discover, with the rest of the world, what progress is being made in other nations advanced in atomic sciences. From the technical papers presented, we'll know, for instance, how far along is the Russian nuclear power program. We'll see concrete evidence of the need for and the strides made in developing nuclear power in Great Britain. We'll find out a lot more about world raw materials supplies.

These will be reflected in U.S. planning. The Atomic Energy Commission can be expected to ease up on secrecy restrictions, if the British, Russians, and others show signs of having more advanced power reactor programs. Or AEC will have to answer to the Joint Congressional Atomic Energy Committee which has already indicated its displeasure over AEC's strictness on information.

AEC May Give More Incentives

AEC may well be forced into a more open-ended industrial participation program as a result of the conference. It may feel the need to give American industry great incentives, such as higher prices for privately produced weapons material, combined with lower rental prices for government-owned and leased fuel elements. It may take such action if we're shown to be losing out in the world race toward developing economic atomic power.

There can be expected other by-products from the knowledge exchanged at the conference. Some of these may come as a result not so much of our government officials becoming acquainted with foreign atomic progress but of our businessmen discovering things.

American suppliers may realize that there's a more pressing need in Britain, for instance, for nuclear power. They'll hear the British delegates discuss their country's critical fuel situation and the rapidly rising demand for electricity, and they'll hear reports of the crash program underway there to develop a full-scale nuclear power industry. They'll compare these facts with those about this country where our traditional sources are far from unable to keep up with demand. They will see that Britain has a greater incentive for proving out the new power source.

New Markets Could Be Opened

Reports from some of the nations will indicate a market for a new power source which they can't afford. Nor do they need large central station nuclear power plants. Perhaps the Americans will discover that there's a large overseas market for American-made package power reactors of small capacity. A concrete result of such a discovery would be immediate pressure on the Army to speed up its power package reactor program and an influx at AEC of designs and plans for more of this type.

Whatever the results as reflected in this country's domestic program, the conference will prove to be an important stepping stone toward international cooperation in peacetime atomic usage on a day-to-day basis. Perhaps the most important thing which may grow out of it, aside from the goodwill created and the knowledge gained by all sides, will be a loosening up of trade barriers to foster the growth of an international market in raw materials, reactors, fuel units, and components.

TECHNICAL NOTES

Outgrowth of experimental automobile propulsion by gas turbine is a portable power unit producing 40 kw at 60 cps. Frequency and voltage are regulated to ±2%. Total weight, including controls, overload protection, and fuel tank, is 1,200 lb.

Delay in reconductoring transmission lines for increased capability until they are so heavily loaded that they cannot be spared for the operation is hardly wise.

Cases of 12-kv capacitor banks are being grounded to cut switch failures. Capacitance between foil and case proved sufficient to charge case to full voltage.

Hazards to operating personnel of an atomic plant may well be less than those present in conventional power plants because of extra-careful control of safety.

High value of negative sequence current in the armature of a generator will cause overheating of the generator's field surface.

Water alone has not proved a satisfactory carrier for applying dormant basal sprays like 2,4,5-T. Some water may be used with oil to control root suckering brush, less for stump or root-collar suckering varieties.

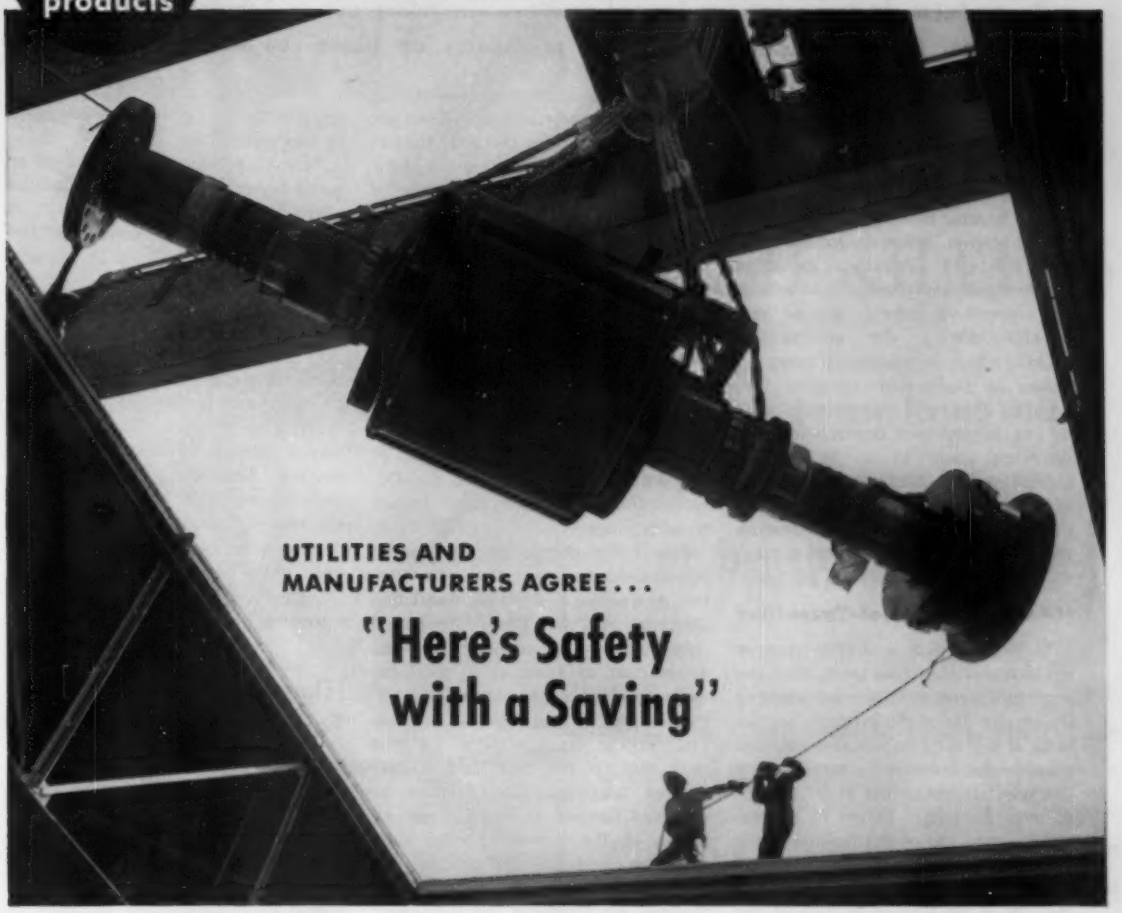
Painting outdoor substation structures and equipment to blend with existing landscaping improves public relations and can eliminate need for further landscaping.

Burner conversion from oil to solid fuel is easy and economical with the cyclone type. The switch involves replacing the burner with one designed for coal feed, stepping up the static air blower, and welding in four small sections of bent tubing.

ACCO products

ACCO Registered* Wire Rope Slings

THE STANDARD OF EFFICIENCY AND SAFETY



• Hoisting equipment like this giant rotor for a 135,000 KW turbo-generator is ticklish business. No preventable risks can be tolerated. That's why manufacturers of electrical generating and transmitting equipment, as well as utility organizations all across the country, have standardized on ACCO *Registered* wire rope slings.

For ACCO *Registered* slings incorporate extra safeguards which make them the safest wire rope slings available. Each individual component, made from the highest quality material suited to its use, is individually tested—must prove to have strength equal to or greater than the sling body.

The components are then precision-assembled into slings according to carefully engineered designs which have proven their safety and efficiency in extensive field tests. Each completed sling is individually proof-tested at twice the load-carrying capacity for which it is rated. Then and only then is the sling awarded the ACCO *Registered* tag and certificate.

This careful engineering and these extensive quality control measures insure precision manufacture and the greatest possible factor of safety. They explain the overwhelming preference for ACCO *Registered* slings in utility and electrical manufacturing operations.

And ACCO *Registered* slings cost less in the long run. Because they have been carefully manufactured according to precisely engineered designs, they last longer—add savings to the additional safety which is their outstanding recommendation for electrical manufacturing and utility use.

*Trade Mark Registered

FREE Sling Notebook

Fifty-six page booklet includes data on sling use, tips on sling care, rated capacity information on all types of wire rope slings.

Write today for your copy

ACCO

TRADE MARK

Wire Rope Sling Department
AMERICAN CHAIN & CABLE

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn. • In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

Better Value

Louisiana PSC Issues New Depreciation Order

Public body uses an accelerated amortization ruling out in February 1953 for handling accounting and rate procedures on liberalized depreciation

An accounting order issued by the Louisiana Public Service Commission with respect to liberalized depreciation is identical with that issued by the commission on accelerated amortization. It became effective in June, 1955.

This earlier order, issued on Feb. 25, 1953, said: "Primarily, the effect of the rapid amortization is to reduce the amount of federal income taxes payable during the amortization period, which in practically every instance is designated as sixty (60) months. This rapid amortization being in lieu of ordinary depreciation will doubtless result in an increase in federal income taxes after completion of the amortization period and during the remaining lives of the properties so amortized, because no depreciation will be deductible for tax purposes.

No Change in Total Taxes

"Ultimate effect is simply to defer the payment of income taxes, since the aggregate income tax payments during the service life of the property are the same if the tax rate remains constant whether the deduction is taken during the amortization period of 60 months or over the longer period of the natural service life of the facilities", the commission order said.

Significantly, the commission noted that "It is the further opinion of the commission and it hereby finds that for rate-making purposes, normal depreciation and the normal federal income taxes that would be applicable should be used."

Accounting Procedure Ordered

As to the accounting disposition, the commission said:

"(1) The books of account shall reflect normal depreciation of the emergency facilities for rate-making purposes.

"(2) The accounting treatment for federal income taxes shall be as follows:

"(a) Charge a new account 'Provision for Deferred Federal Income Taxes' as a separate subaccount under Account 507-Taxes, and credit to 'Reserve for Deferred Federal Income Taxes' as a separate subaccount under Account 258.2 Miscellaneous Reserves, an amount equal to the reduction in federal income taxes arising out of the special amortization as provided in Section 124A of the Internal Revenue Code, in lieu of the normal income tax depreciation of the cost of such facilities.

Steps After Amortization

"(b) After such amortization under each necessity certificate is completed or is discontinued by the utility, and thereafter during the life of such property or until the earlier exhaustion of the portion of the Reserve for Deferred Federal Income Taxes related to such property;

"(b-1) To charge to the Special Reserve account and to credit 'Portion of Current Federal Income Taxes Deferred in Prior Years' a separate subaccount under Account 507, Taxes, an amount or amounts in total for each year for each necessity certificate, equal to the increase in federal income taxes payable for that year due to the fact that normal income tax depreciation cannot be deducted because of previous amortization of the property under such necessity certificates and

"(b-2) In the event that emergency facilities are retired in any year prior to the exhaustion of the portion of the Reserve for Deferred Federal Income Taxes related to such property, to transfer the balance so related to Account 507, Taxes, or to Account 271, Earned Surplus upon specific instructions of this commission. In each such case, consideration will be given by this commission to the circumstances and the amount to be transferred.

Supporting Records Necessary

"(c) To maintain supporting records with respect to each necessity certificate to reflect:

1. The amount of plant costs amortized.

2. The resulting reduction in federal income taxes.

3. The entries made in accordance with this order.

4. Any other pertinent information relative thereto as may be requested by this commission.

"(d) To provide in its books of account for retirement of the properties covered by the necessity certificates by appropriations to Reserve for Depreciation of Utility Plant in amounts consistent with its practice for like property not covered by necessity certificates," the public utilities commission order said.

At the present moment, the states of Alabama, Indiana, Virginia, and West Virginia prescribe a restricted surplus method of accounting for the deferral. The states of Illinois, Louisiana, Maine, and Michigan use the tax reserve method. Florida has suspended its order pending further hearings.

Island Utility Postpones Forming New Company

Hawaiian Electric Co has revealed why its plan to set up a separate company to operate its merchandising division—announced in February—has not materialized.

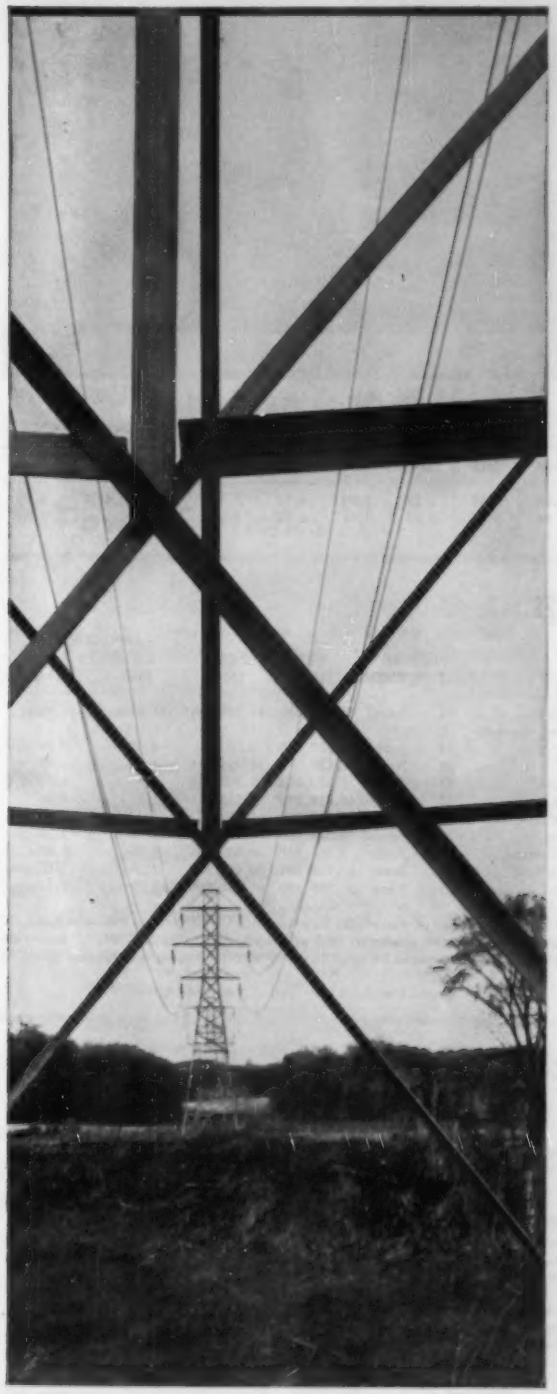
The company explained it is negotiating with bondholders in hopes of getting its trust mortgage amended so the merchandising division's $3 million worth of property can be transferred to the new corporation free of the mortgage.

The utility's bonds, some $28 million worth are outstanding, are secured by a trust mortgage on all the company's property. The mortgage question must be settled before the Hawaiian Electric Supply Co division can be separated from Hawaiian Electric.

Decision to form a subsidiary corporation killed interest in a bill before the legislature which would have forced Hawaiian Electric out of the merchandising business. It was backed by a group of appliance dealers in the territory.

(*More Finance on page* 198)

from a maintenance point of view . . .



DOW BRUSH KILLERS

cut costs in keeping right-of-ways clear of brush and weeds

Maintenance departments and spray service organizations can rely on specific Dow products doing specific jobs to cut costs of right-of-way vegetation control. It will pay you to get complete information on Dow brush and weed killers and their place in your maintenance program. Write us for information and assistance on the use of Esteron® 245, Esteron Brush Killer and the new brush killer, Kuron. THE DOW CHEMICAL COMPANY, Agricultural Chemical Sales Department, Midland, Michigan. In Canada: Dow Chemical of Canada, Limited, Toronto, Canada.

you can depend on DOW AGRICULTURAL CHEMICALS

FINANCIAL BRIEFS

Institutional Investors Mutual Fund, Inc, has purchased the following common stocks of electric companies in the second quarter of 1955: 1,000 shares of American Gas & Electric Co; 800 shares of Cincinnati Gas & Electric Co; 200 shares each of Commonwealth Edison Co and Consolidated Edison Co of New York; 300 shares of Gulf States Utilities Co; 400 shares of Louisville Gas & Electric Co, and 1,500 shares of Northern States Power Co (Minn.).

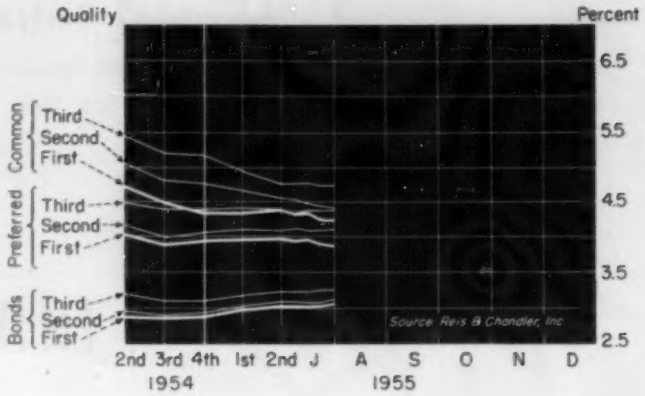
Puget Sound Power & Light Co's Pres Frank McLaughlin has made the charge that a letter sent out by a stockholders' committee asking for a merger with Washington Water Power Co is "gravely misleading in many important respects" and omits "much vital information."

International Bank for Reconstruction and Development has approved two 20-year loans totaling $7.5 million, bearing interest of 4¾%, for electric power development in Nicaragua. The project includes the construction of a 30,000-kw thermal plant in Managua, transmission lines to 15 outlying towns, and expansion to the distribution systems in Managua and the towns. It marks the transition of the Nicaragua power industry from the phase of scattered diesel plants to that of an organized power network with facilities capable of satisfying an expanding market.

Home Light & Power Co plans to sell to its stockholders 7,313 additional shares of common stock at $40 a share.

Future Financing . . . Bonds—$10 million by Florida Power & Light Co; $15 million by Long Island Lighting Co; $25 million by New York State Electric & Gas Corp; $25 million by Puget Sound Power & Light Co; $30 million by Union Electric Co of Mo., and $8.5 million by Worcester County Electric Co . . . **Preferred Stock**—80,000 shares $100 par by Arkansas Power & Light Co, 30,000 shares $100 par by Pacific Power & Light Co . . . **Common Stock**—1,004,870 shares by Southern Co under a stock rights offering on a 1-for-8 basis to stockholders of record Oct. 19. . . . **Debentures**—$35 million by Public Service Electric & Gas Co.

Today's Utility Yields (%)



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
QUALITY.....	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
July 28.....	3.08	3.12	3.25	3.93	4.05	4.37	4.25	4.37	4.71
July 21.....	3.04	3.08	3.22	3.94	4.06	4.36	4.27	4.42	4.71

Utility Earnings

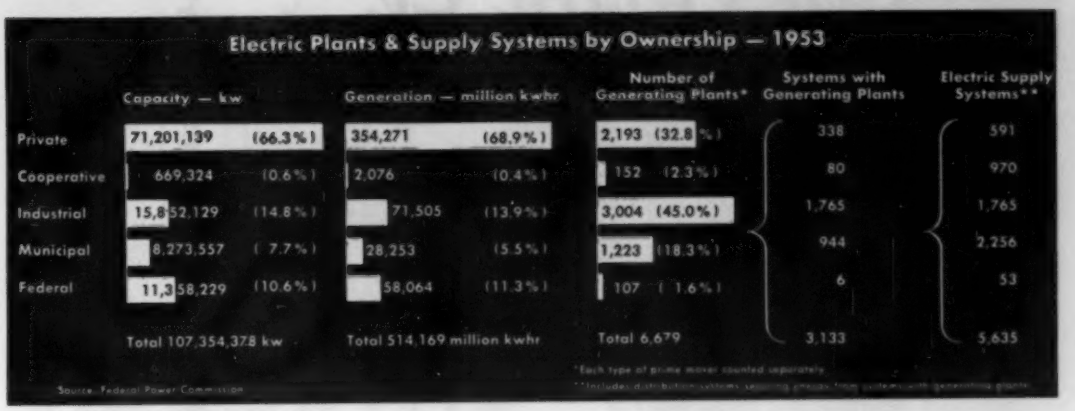
COMPANY	PERIOD MONTHS	ENDED	NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
Central Illinois Light.....	12	June	$3,544,846	$3,384,146	$3.04(a)	$2.88(a)
Central & Southwest, consolidated.....	12	June	7,737,678	.....	0.80(b)	0.76(b)
Consumers Power.....	12	June	27,657,076	25,963,513	3.25	3.17
Florida Power & Light.....	12	June	12,379,012	9,350,302	1.83(c)	1.70(c)
Houston Lighting & Power.....	12	June	13,619,890	11,150,011	2.27	2.04
Iowa Southern Utilities.....	12	June	1,298,594	1,193,032	1.57(f)	1.43(f)
Long Island Lighting.....	12	June	9,718,551	8,621,132	1.28(g)	1.31(g)
New York State & Electric.....	12	June	9,951,347	9,607,986	2.75	2.69
Ohio Edison, consolidated.....	12	June	21,936,559	19,664,678	3.30(a)	3.05(a)
Philadelphia Electric.....	12	June	31,557,180	30,678,900	2.31(a)	2.42(a)

Notes—(a) Based on average number of shares; (b) Based on 9,691,257 shares in 1955 and 9,091,257 shares in 1954; (c) Based on 6,000,000 shares in 1955 and 4,900,000 shares in 1954; (f) Based on 748,083 shares in 1955 and 742,551 shares in 1954; (g) Based on 6,241,703 shares in 1955 and 5,340,259 shares in 1954.

Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
SCHEDULE FOR AUGUST-SEPTEMBER			
BONDS			BID DATE
California Electric Power—1st mtg.....	$6,000	.....	Aug .30
Utah Power & Light—1st mtg due 1985.....	15,000	.....	Sept. 13
Ohio Power—1st mtg.....	17,000	.....	Sept. 20
Pacific Power & Light—1st mtg.....	10,000	.....	Sept. 27
PREFERRED STOCK			
Public Service Electric & Gas—250,000 sh $100 par....	25,000	.....	.....
Ohio Power—60,000 sh $100 par.....	6,000	.....	Sept. 20
COMMON STOCK			
California Electric Power—230,000 sh.....	.....	.....	Aug. 23
Housatonic Public Service—14,817 sh (to be offered commonholders on 1-for-25 basis, record Sept. 5 to expire Sept. 26).....	.....	.....	.....
Utah Power & Light—177,500 sh.....	.....	.....	Sept. 13

STATISTICS



Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	June	107.62	106.32	95.31	12.9
Peak—Class I Systems . million kw	May	83.9	82.4	74.0	13.4
Estimated Dec. '55 Peak	Mar.	96.5	96.4	96.0	0.6
Production—billion kwhr	May	43.35	42.03	37.43	15.8
hydro		9.81	10.47	10.35	−5.1
fuel		33.54	31.56	27.08	23.8
Sales—billion kwhr	May	39.57	39.56	33.60	17.8
residential		9.71	10.54	8.88	9.4
commercial		6.18	6.14	5.68	8.8
industrial—includes sales to AEC		21.35	20.51	16.89	26.4
other		2.33	2.37	2.16	7.9
Fuel Consumption	May				
coal—million tons		10.76	10.12	8.67	24.1
oil—million barrels		4.88	5.68	4.25	14.9
gas— billion cu ft		103.43	92.82	94.70	9.3
Net Income Class A & B Co's—$ million	Apr.	105.46	107.80	95.87	10.0
Residential Customers—millions	12 mos.	43.51	43.44	42.23	3.0
revenue per kwhr	ended	2.67¢	2.68¢	2.72¢	−1.8
avg. kwhr per customer	Apr.	2,622	2,606	2,417	8.5
avg. annual bill		$70.01	$69.84	$65.74	6.5

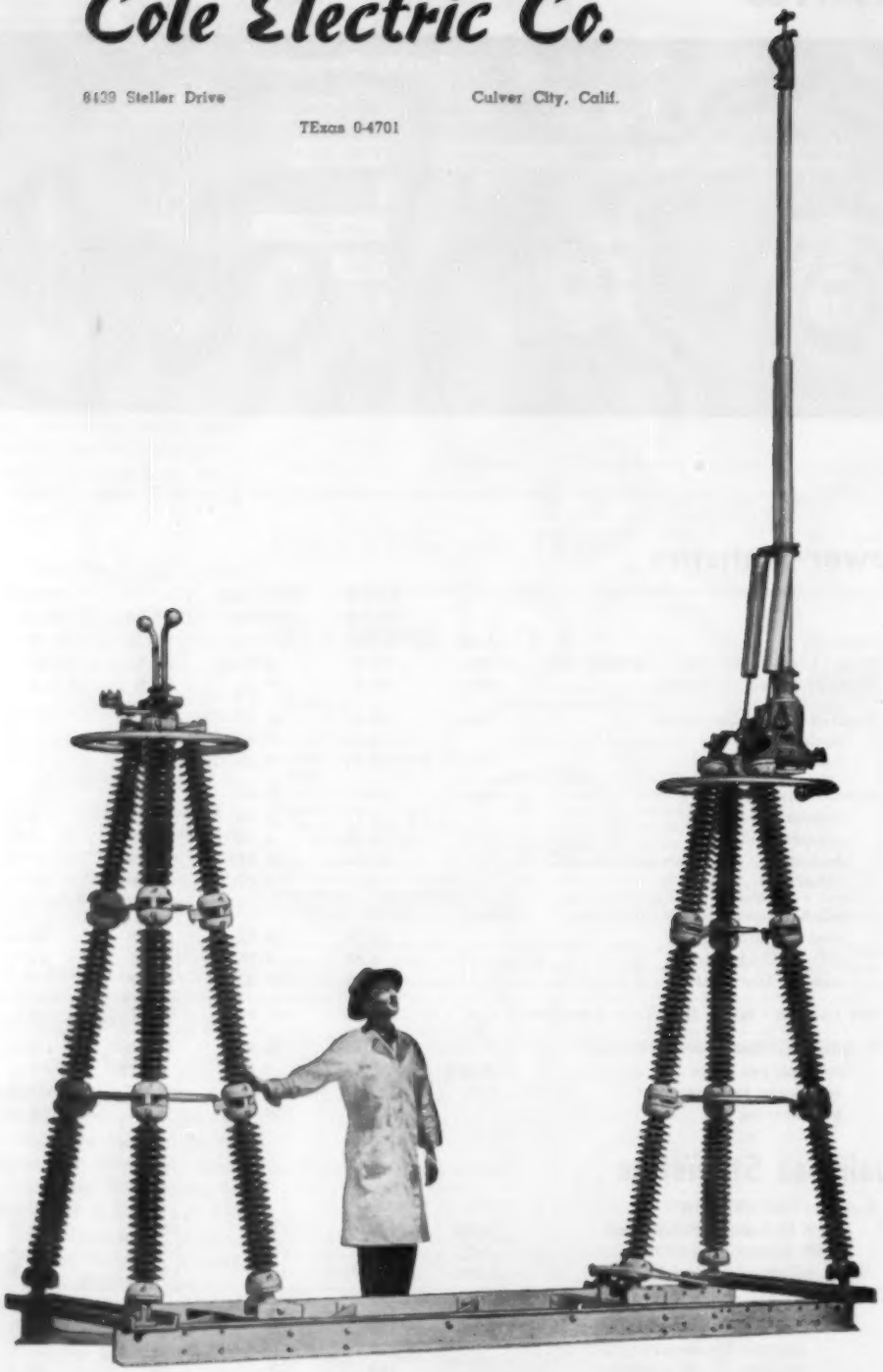
Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	June	138	138	124	11.3
ENR Construction Cost	July	138.4	137.5	135.0	2.5
BLS Cost-of-Living	June	114.4	114.2	115.1	−0.6
NEMA Sales	May				
insulation materials		154	160	116	32.8
electric appliances		110	105	89	23.6
household refrigerators		104	96	74	40.5
Wholesale prices	June				
motors and generators		120.8	120.8	123.7	−2.3
transformers and regulators		127.3	127.3	128.1	−0.6
switchgear and fuses		135.6	135.6	135.1	0.4
GNP—annual rate—$ billion	2nd Qtr.	$383.0	$375.3	$357.6	7.1

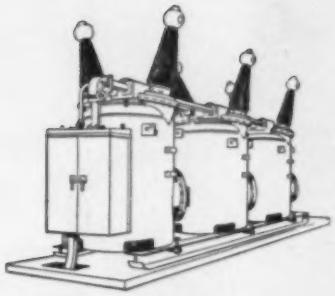
Cole Electric Co.

8439 Steller Drive — Culver City, Calif.

TExas 0-4701



AIR BREAK DISCONNECTING SWITCH
230,000 Volts—1200 Amperes—Type MO-2
Vertical Break—Three Pole, Single Throw
SILVER TO SILVER CONTACTS
Group Operated
(One Pole Shown)

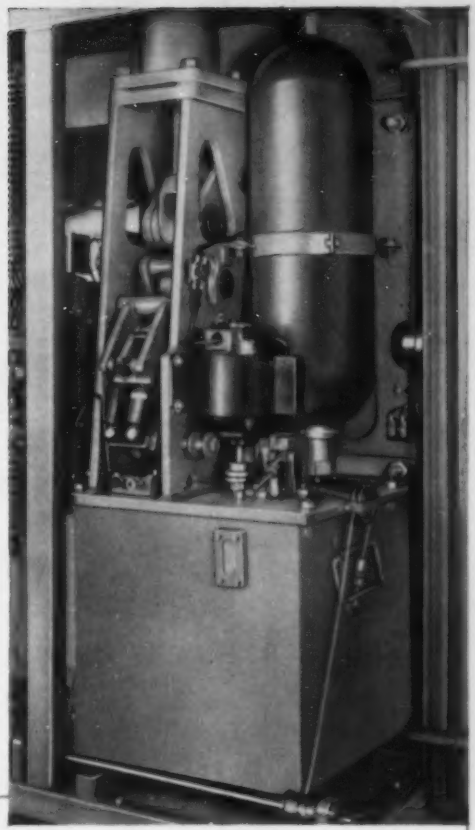


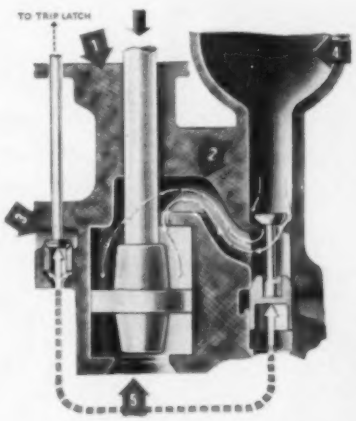
HYDRAULIC OPERATOR

TYPE OA

FOR HIGH VOLTAGE POWER CIRCUIT BREAKERS

FEDERAL PACIFIC Type OA Hydraulic Operating Mechanism is unmatched for smooth operation, precise motion control and low maintenance cost. The hydraulic power flow takes place in a solid block of steel, which is submerged in oil at atmospheric pressure. This eliminates power flow pipes and fittings, solves all leakage problems, gives high safety factor, and results in a simple, integrated design.





1. **Hydraulic power flow in rugged steel casting eliminates pipes and fittings.**
2. **Large, short oil duct eliminates shocks and surges.**
3. **Trip-free in any position of closing stroke. Speed and smoothness of action unsurpassed.**
4. **Accumulator charge easily checked while circuit breaker remains in service.**
5. **Plug below piston enters into this orifice to effect shock absorbing. Have six years experience with this type hydraulic component.**

For complete details, secure Catalog 587 from Pacific Switchgear Division, Federal Pacific Electric Company, 5815 Third Street, San Francisco, California.

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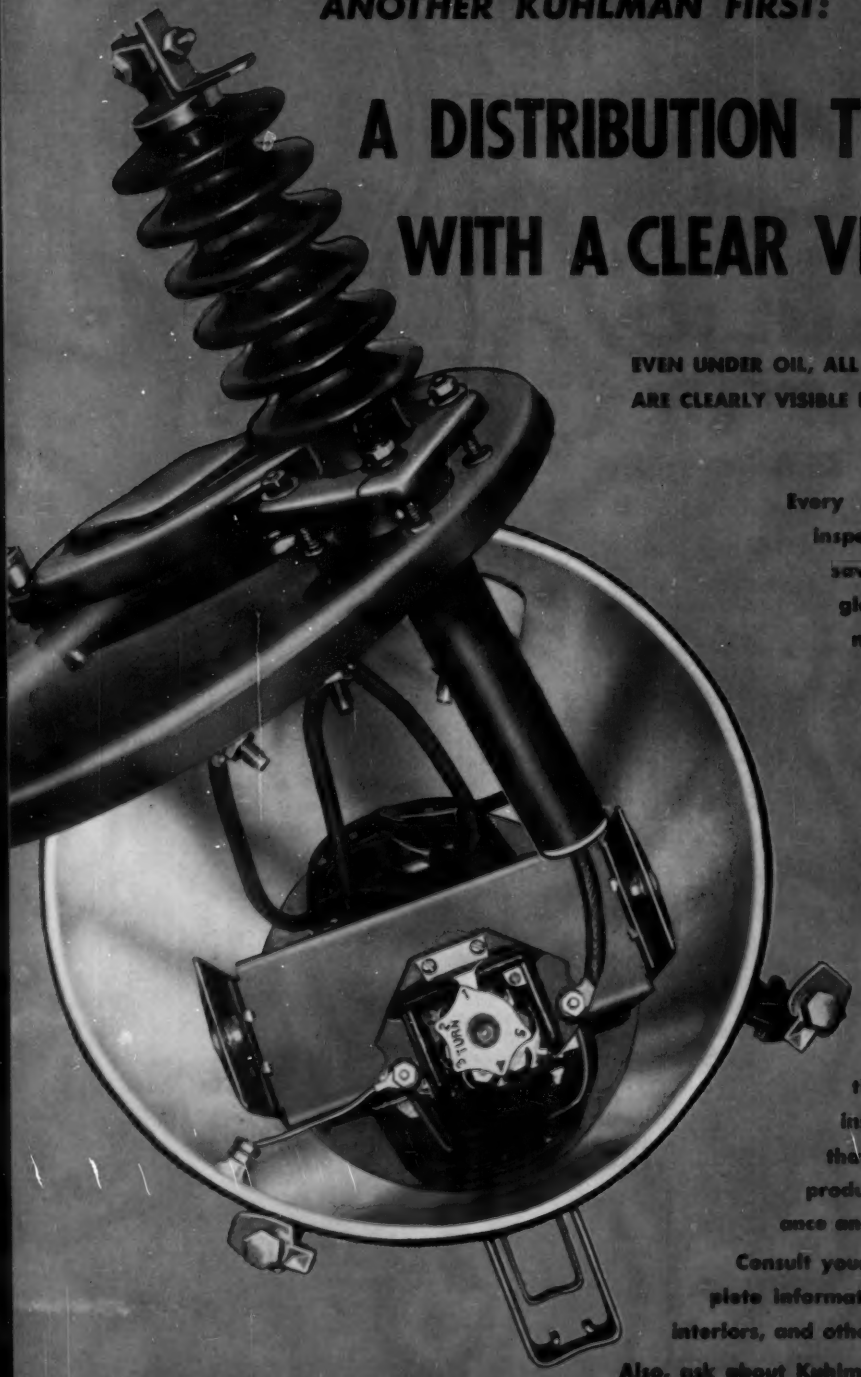
ANOTHER KUHLMAN FIRST:

A DISTRIBUTION TRANSFORMER WITH A CLEAR VIEW INTERIOR



EVEN UNDER OIL, ALL TRANSFORMER COMPONENTS ARE CLEARLY VISIBLE FOR INSPECTION.

Every utility man knows that periodic inspection of distribution transformers saves on maintenance costs. Kuhlman's gleaming white interior tank walls make the inspection job easier. All connections, operating parts, and the bottom of the tank are clearly visible. The condition of the oil, vitally important to long transformer life, can easily be observed to insure top transformer performance.

Yes, Kuhlman white tank wall interiors invite your inspection. You can see for yourself the sturdy, compact construction and skillful workmanship of Kuhlman distribution transformers. Inspection after inspection will offer positive proof that Kuhlman transformers are quality products built for trouble-free performance and easy maintenance.

Consult your Kuhlman representative for complete information on Kuhlman's new clear view interiors, and other exclusive features.

Also, ask about Kuhlman's porcelain enameled finish for corrosive atmospheric conditions.

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